



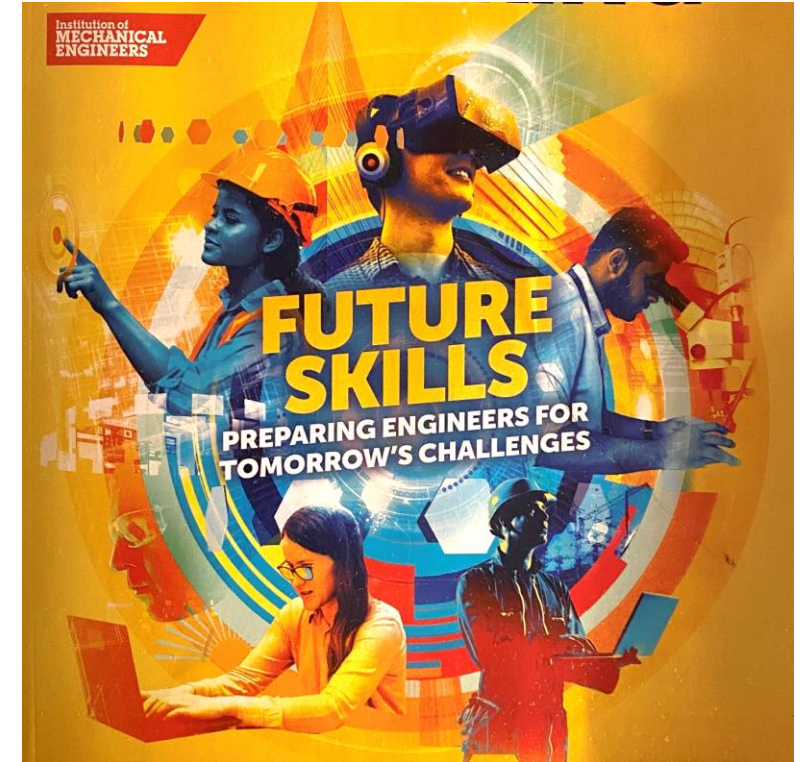
Introduction to sustainability strategies and the circular economy, or the challenge for the composites industry

Dr. Martyn Wakeman

martyn.wakeman@epfl.ch

Learning objectives

- Understand why we need a circular economy
- Describe the limits of linear economic models
- Explain how we can change to a circular economy in engineered products
- Design your own circular initiatives



**Now is the most
exhilarating time to be
an innovator.**

- Sustainability
- NetZero transition
- Linear vs. circular economy
- Circular economy frameworks
- Materials and engineered product examples
- Enablers to a CE
- Initiatives

NetZero 2050: what is your vision?



[AP to set up solar-wind hybrid project with battery back-up – The Leading Solar Magazine In India \(eqmagpro.com\)](#)



[Daily Mail Online](#)



[EV World Record: Mercedes Benz Vision EQXX Travels 1,000 Km On A Single Charge \(forbes.com\)](#)



[Support Rewilding — The Scottish Rewilding Alliance](#)



[ZEROe on the Rise at Airbus - CAFE Foundation Blog](#)



[\[기업소개\] 수소연료탱크 제조사 '일진다이아': 네이버 블로그 \(naver.com\)](#)



[Child Fun Outdoors - Free photo on Pixabay](#)



[4 NetZero Energy Lessons | NetZero Buildings](#)



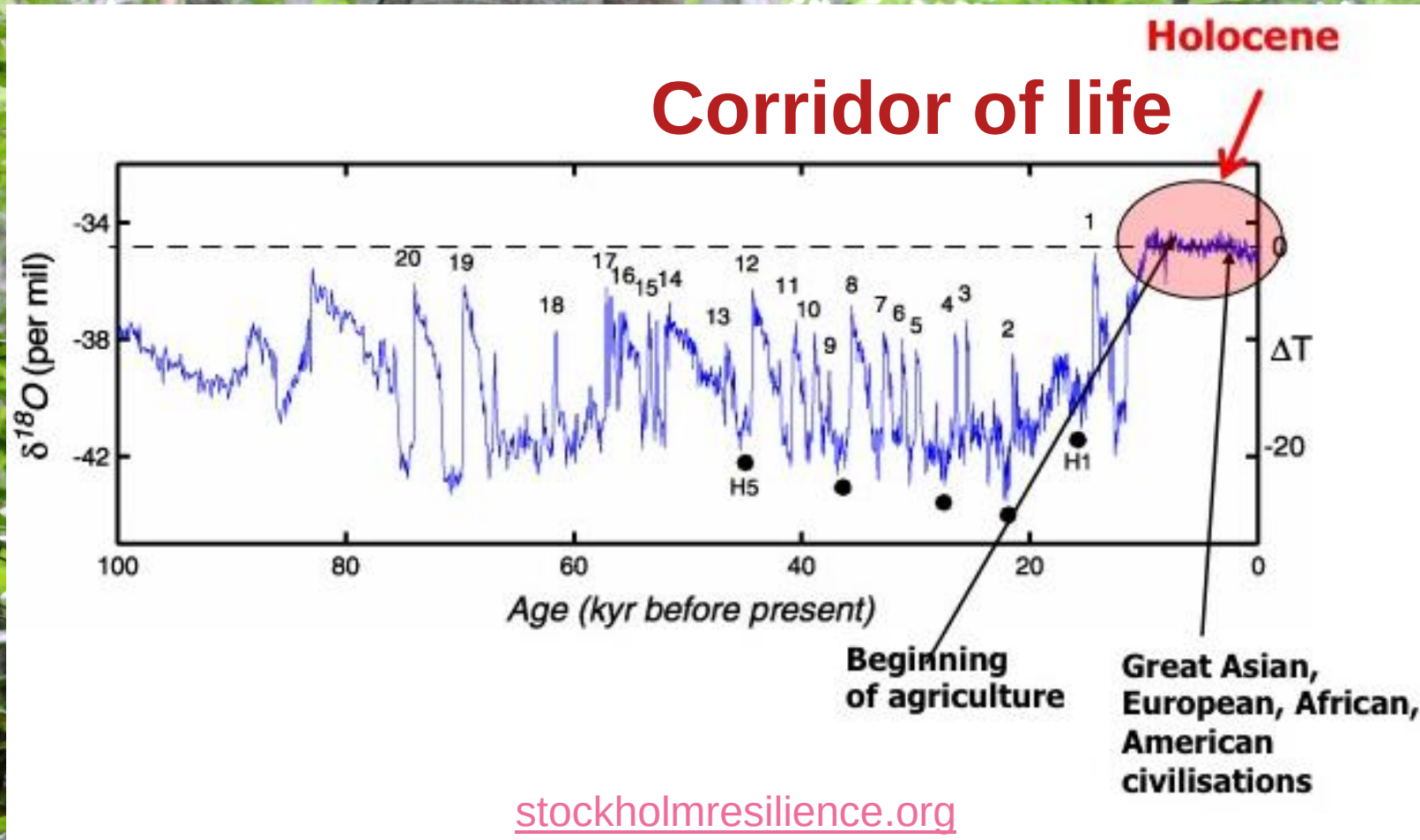
[People Group Many - Free photo on Pixabay](#)

Sustainability can be defined as:

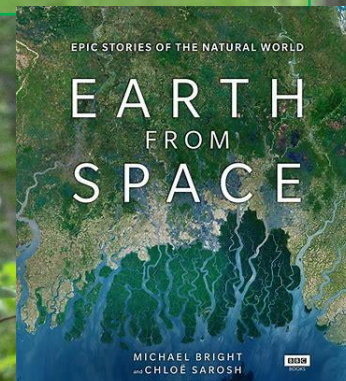
"Avoiding the depletion of our natural resources in order to maintain a balanced ecosystem and preserve natural capital *while* meeting the **needs** (wants?) of the present without compromising the ability of future generations to meet their own **needs**".

Holocene

the stable geological epoch in the earth history that has lead to our blue and green planet



- Relatively stable Holocene climate during the past ca. 10,000 years
- Record from Greenland Ice Sheet, proxy for atmospheric temperature over Greenland

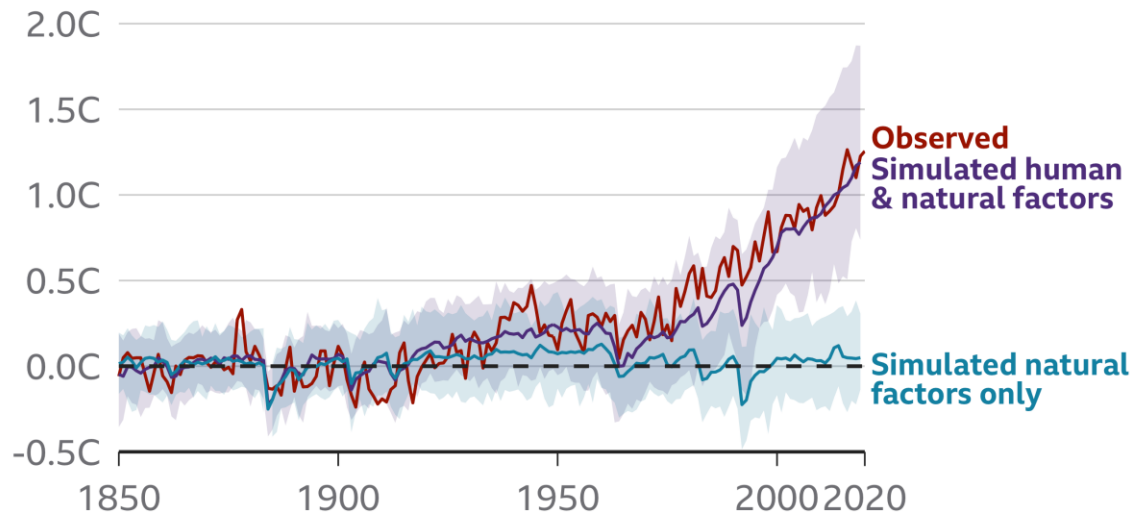


Our planet is getting warmer, CO₂e driven

- Unequivocal warming through human activity

Human influence has warmed the climate

Change in average global temperature relative to 1850-1900, showing observed temperatures and computer simulations



Note: Shaded areas show possible range for simulated scenarios

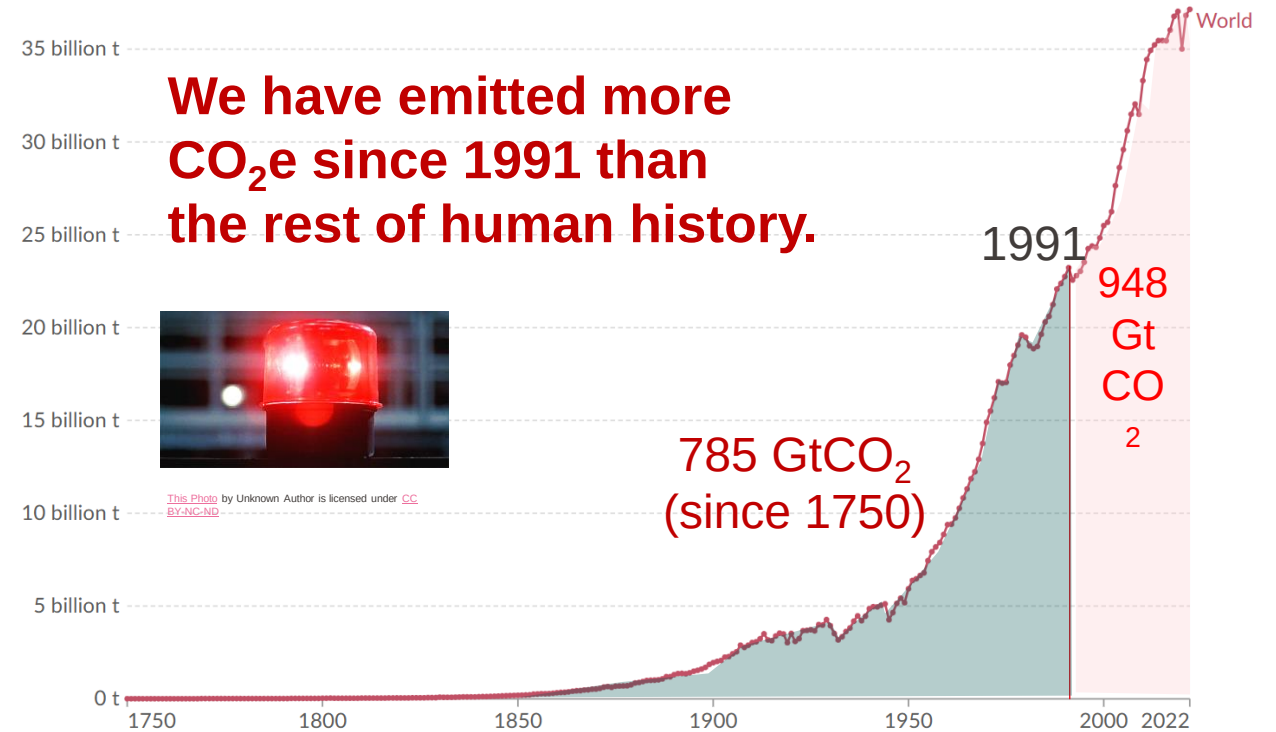
Source: IPCC, 2021: Summary for Policymakers



Annual CO₂ emissions

Carbon dioxide (CO₂) emissions from fossil fuels and industry¹. Land-use change is not included.

Our World in Data



Data source: Global Carbon Budget (2023)

OurWorldInData.org/co2-and-greenhouse-gas-emissions | CC BY

1. **Fossil emissions:** Fossil emissions measure the quantity of carbon dioxide (CO₂) emitted from the burning of fossil fuels, and directly from industrial processes such as cement and steel production. Fossil CO₂ includes emissions from coal, oil, gas, flaring, cement, steel, and other industrial processes. Fossil emissions do not include land use change, deforestation, soils, or vegetation.

[CO₂ emissions - Our World in Data](#)

$$k = Ae^{\frac{-E_a}{RT}}$$

*On the Influence of Carbonic Acid
in the Air upon the Temperature of
the Ground*

Svante Arrhenius

Philosophical Magazine and Journal of Science

Series 5, Volume 41, April 1896, pages 237-276.

This photocopy was prepared by Robert A. Rohde for Global Warming Art (<http://www.globalwarmingart.com/>) from original printed material that is now in the public domain.

Arrhenius's paper is the first to quantify the contribution of carbon dioxide to the greenhouse effect (Sections I-IV) and to speculate about whether variations in the atmospheric concentration of carbon dioxide have contributed to long-term variations in climate (Section V). Throughout this paper, Arrhenius refers to carbon dioxide as "carbonic acid" in accordance with the convention at the time he was writing.

THE
LONDON, EDINBURGH, AND DUBLIN
PHILOSOPHICAL MAGAZINE
AND
JOURNAL OF SCIENCE.

[FIFTH SERIES.]

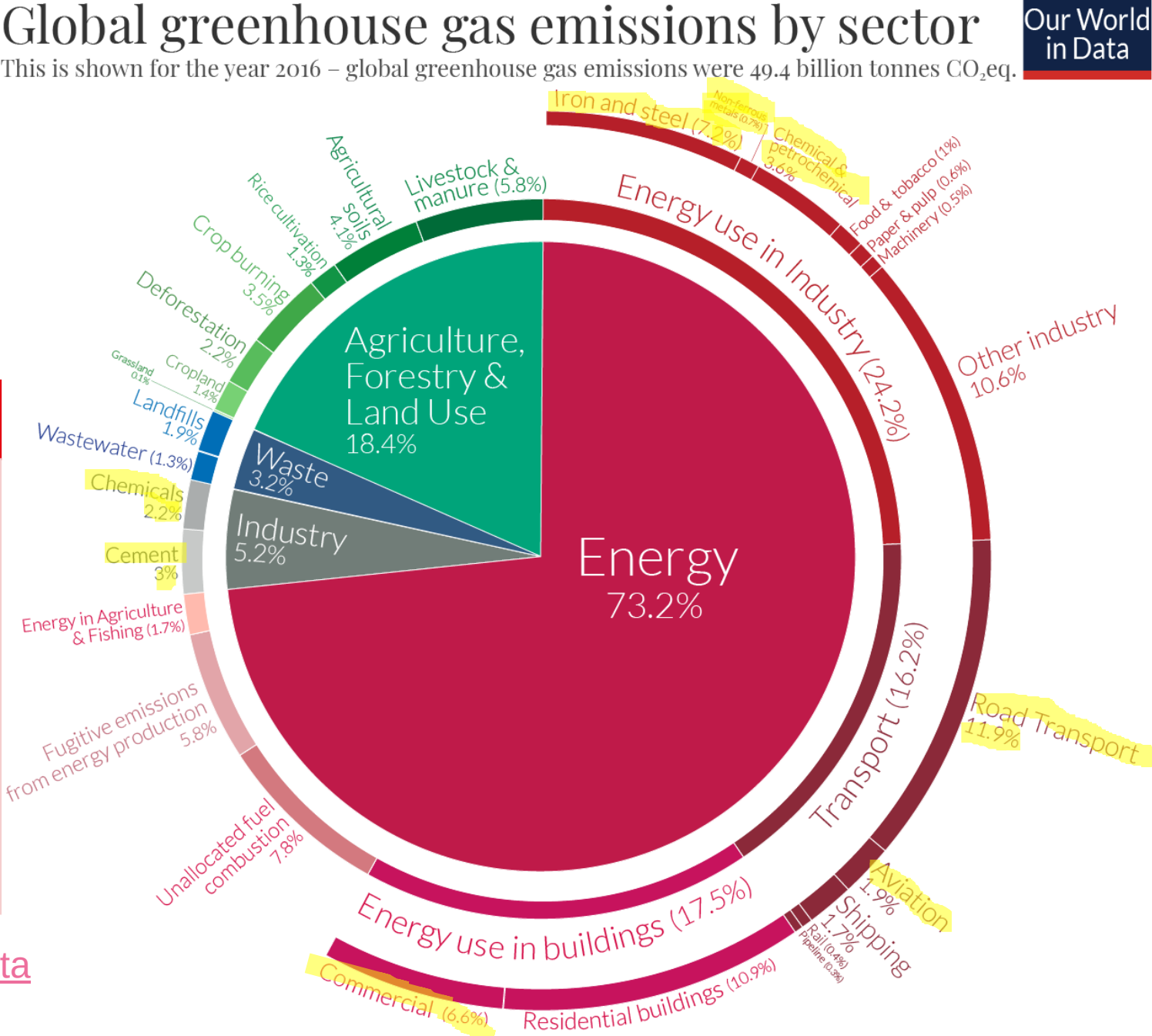
APRIL 1896.

XXXI. *On the Influence of Carbonic Acid in the Air upon
the Temperature of the Ground.* By Prof. SVANTE
ARRHENIUS *.

Major GHG contributors

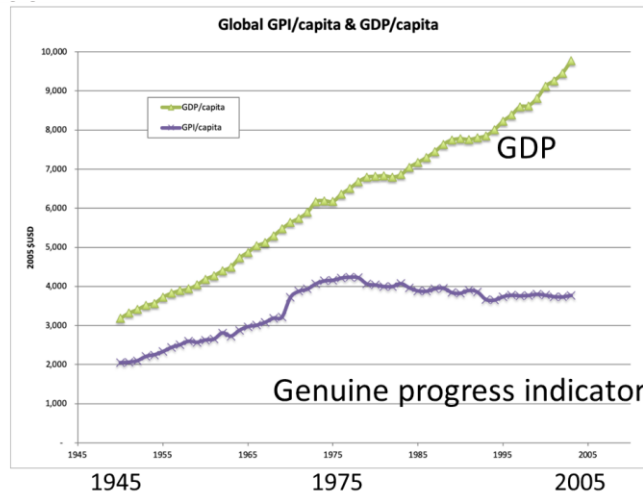
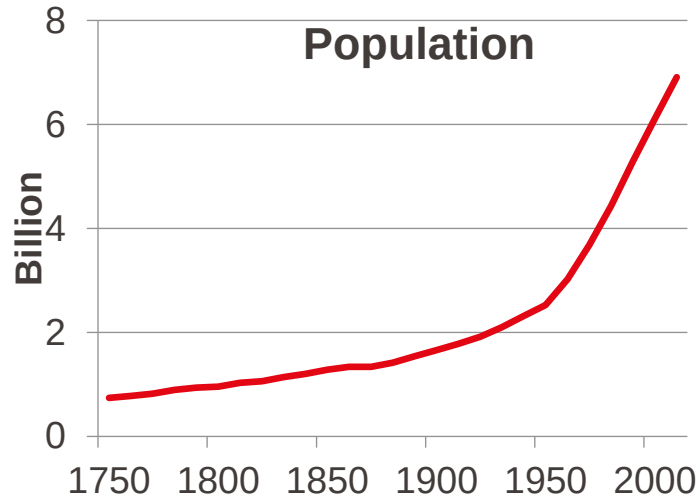
■ Engineered products touch

Transport 16%	Chemicals 5.8%	Materials 20%
• a leading source of greenhouse gas emissions • Road 12% • Aviation 1.9% • Shipping 1.7%	• 2.2% manufacturing • 3.6% powering chemical industry	• Steel 7% • Plastic 3% • Aluminum 0.5% • Copper 0.1% • Cement 3-5% • Battery materials 0.1% • Coal/energy mining 3-4% • Other metals 1%

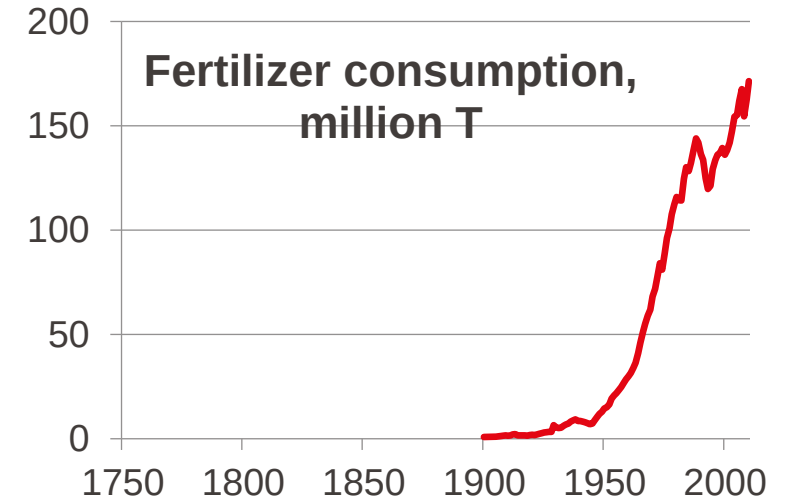
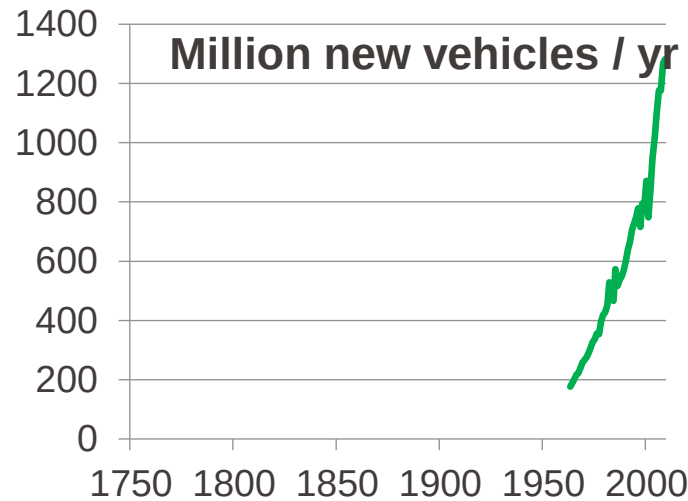
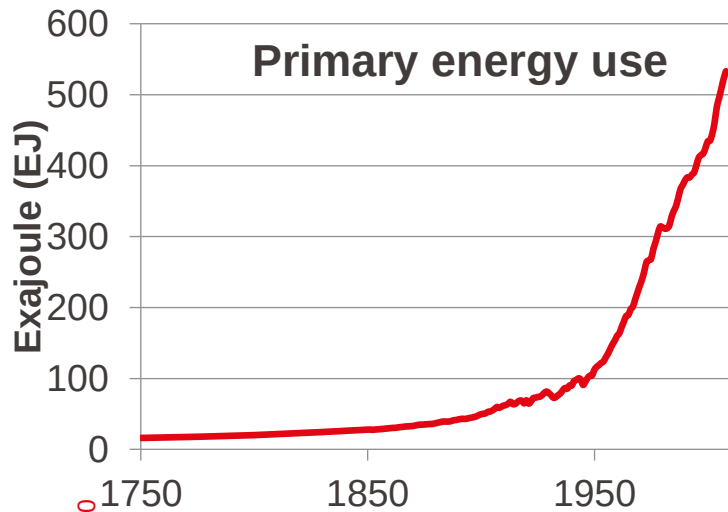
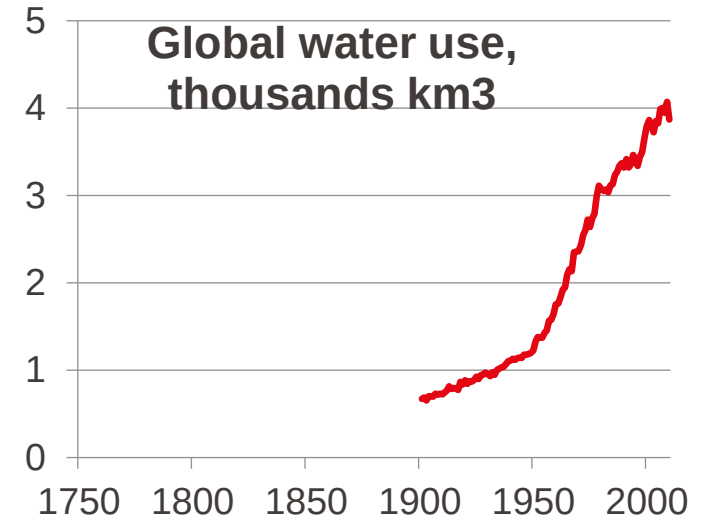


Emissions by sector - Our World in Data

The great acceleration: Socio-economic trends (6 of 12)



Since 1978, Genuine Progress has been falling even while GDP continues to increase.
Credit: Kubiszewski et al., *Beyond GDP: Measuring and achieving global genuine progress*

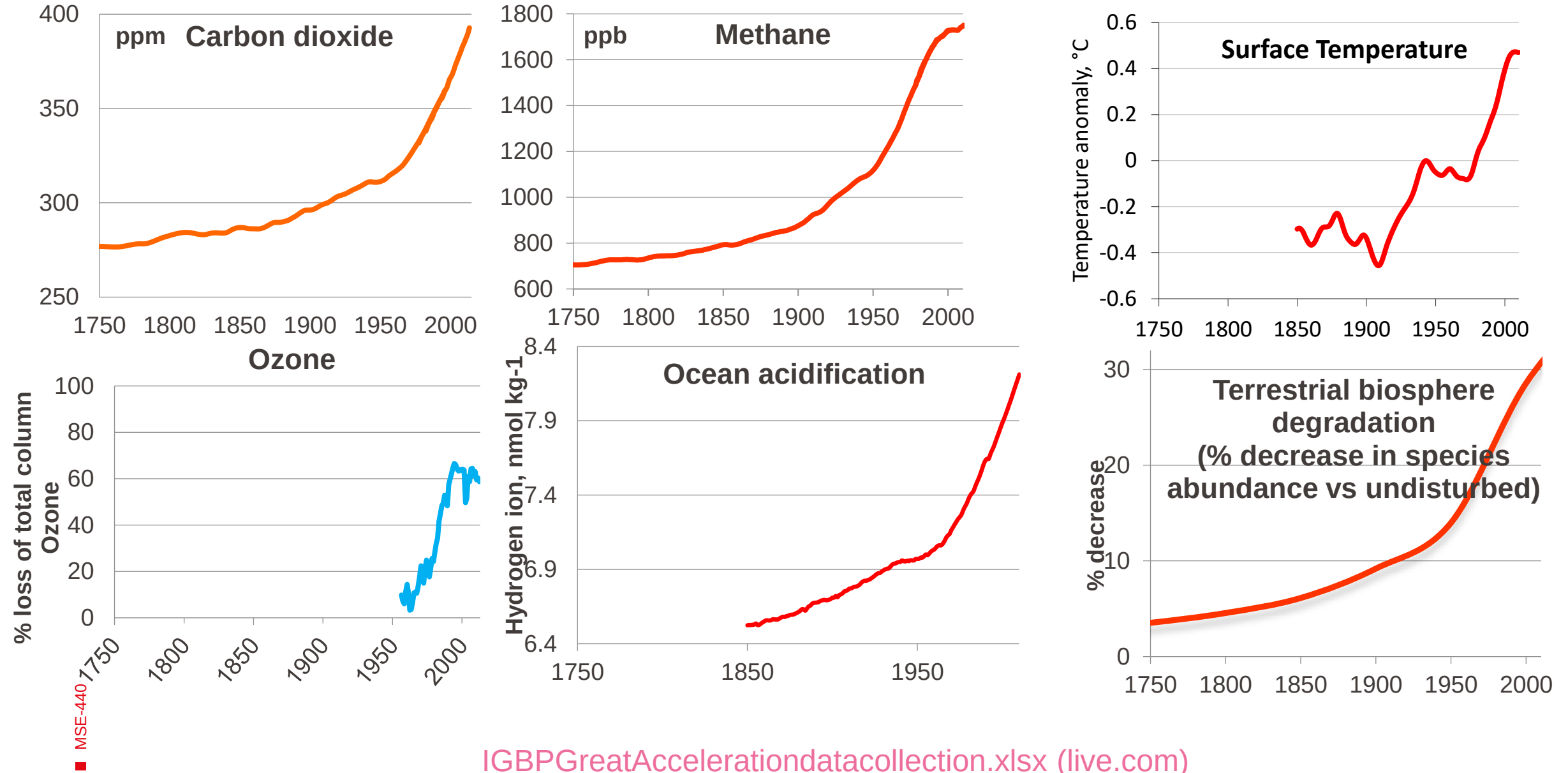


■ MSE-440

[IGBPGreatAccelerationdatacollection.xlsx \(live.com\)](https://www.igbp.org/GreatAcceleration/datacollection.xlsx)

GPI = GDP (value of all goods and services produced) minus the environmental and social costs

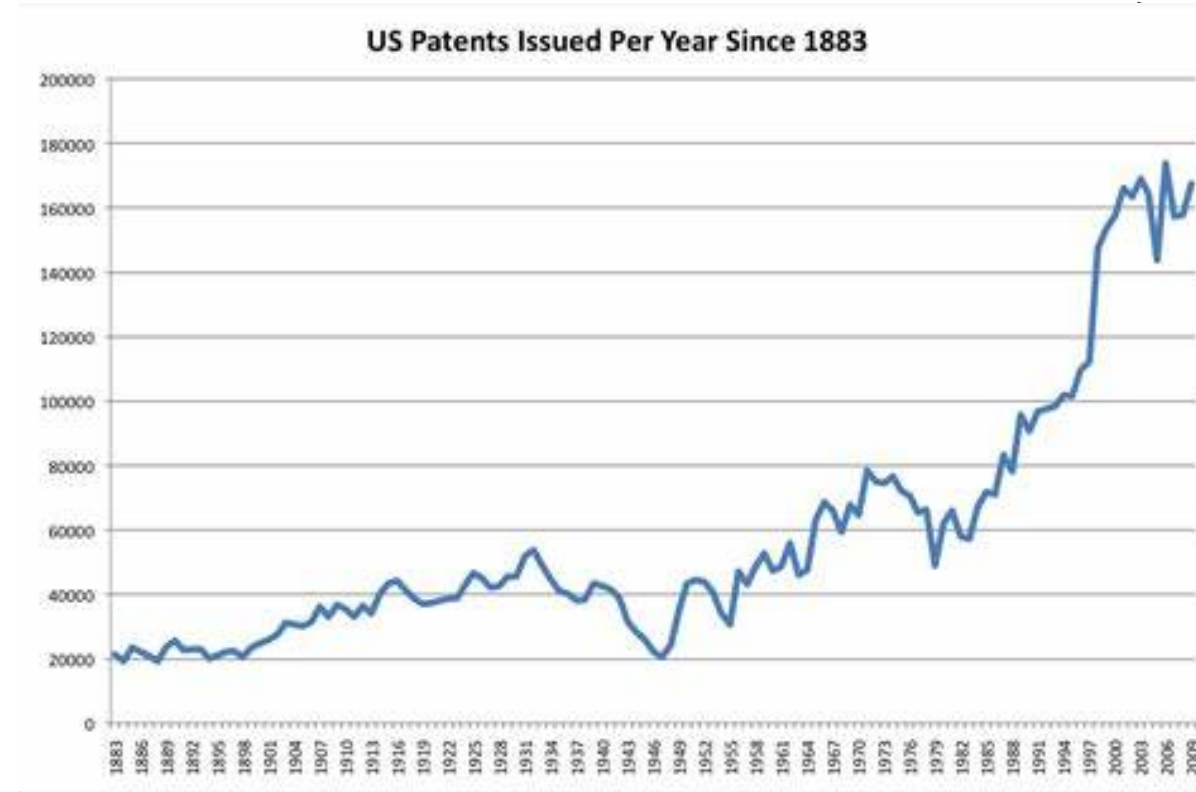
The great acceleration: Earth System trends (6 of 12)



- Find a way to capture the amazing advances we have made as a human society (health, longevity, science, technology, travel, art ...)

but

- in a sustainable way
(without taking a mortgage on future generations)
- Value our own mental and physical health
- A remapping of we how we become more advanced as a society



Research: part of the great acceleration



Planetary boundary model

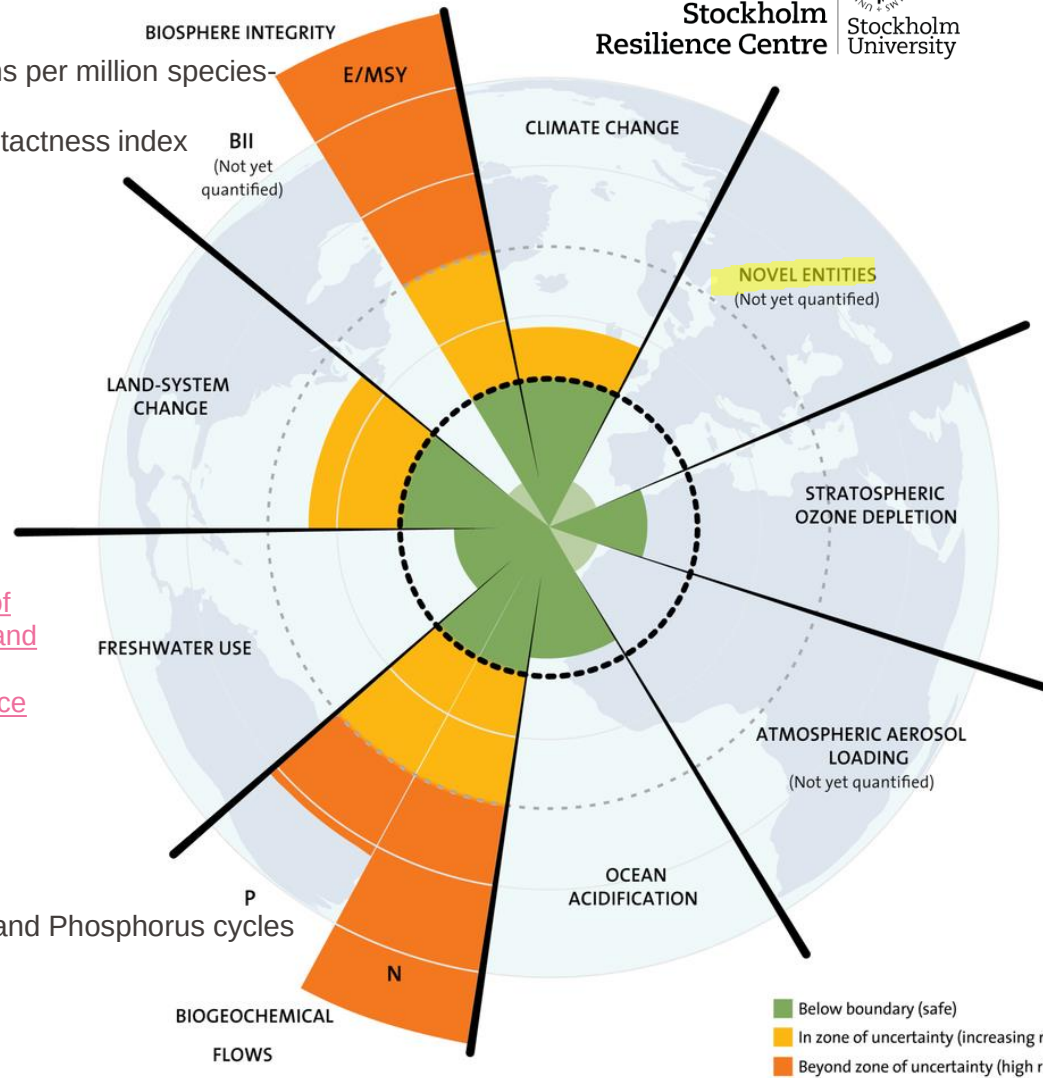


Stockholm
Resilience Centre

E/MSY = extinctions per million species-years

BII = biodiversity intactness index

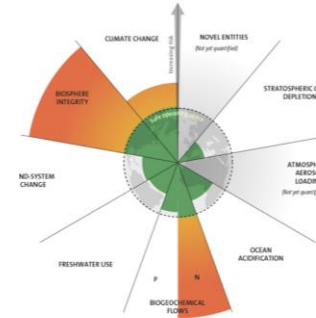
BII
(Not yet
quantified)



Steffen et. al, 16 January 2015, Science

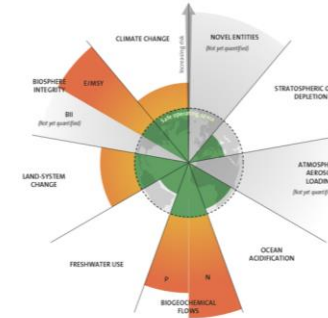
The tipping points of climate change — and where we stand - Stockholm Resilience Centre

2009



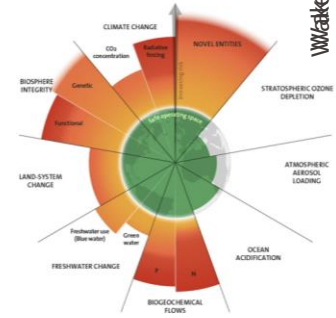
7 boundaries assessed,
3 crossed

2015



7 boundaries assessed,
4 crossed

2023



9 boundaries assessed,
6 crossed

[PB over time. 2009, 2015, 2023.jpg](#) | Powered by Box



[Let the environment guide our development | Johan Rockstrom - YouTube](#)

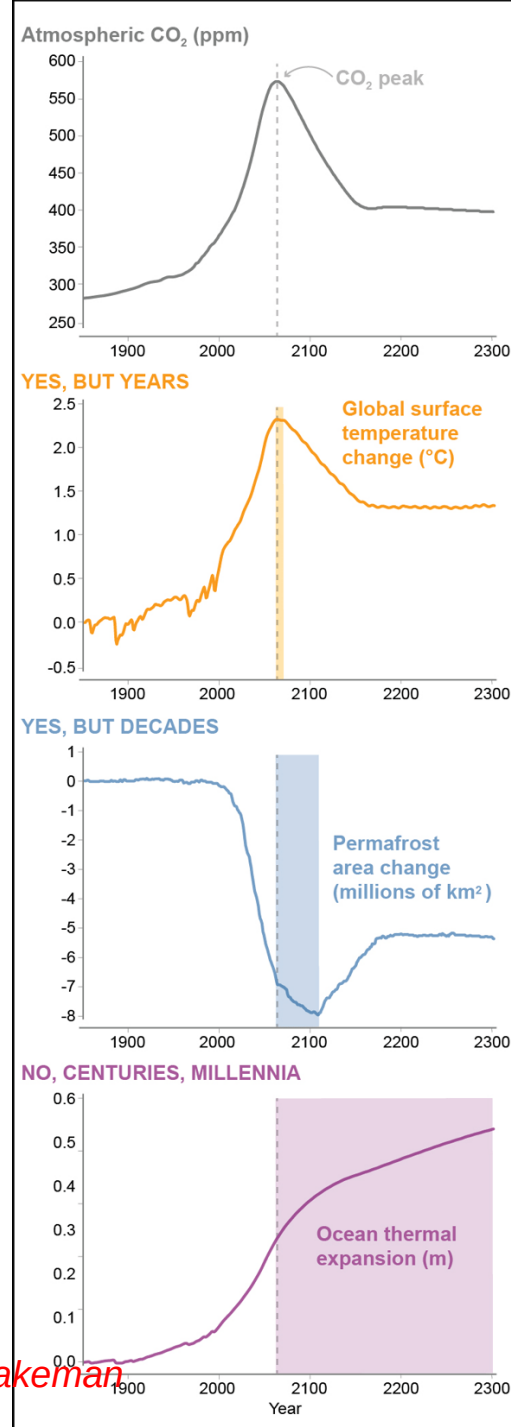
Time lines of reversal

- Global surface temperature: years
- Permafrost: decades
- Ocean expansion: millennia

Reversal outside of pricing and economics (Significant non-trivial externalities not considered by economics)

Carbon dioxide stays in atmosphere for centuries to millennia, but carbon removal accelerates the natural cycle to store excess carbon in soil, plants, or water.

A simplified computer model shows how long Earth systems take (years to centuries) to rebound following peak CO₂ emissions (vertical gray dashed lines in each plot). Credit: IPCC [2021], FAQ 5.3

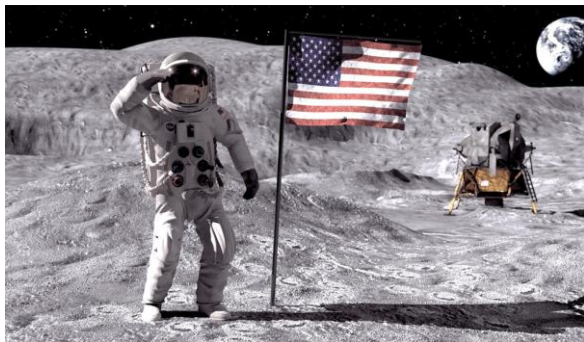


Mark Carney, ex governor of the bank of England

- climate change is the “**Tragedy of the Horizon**”
- The catastrophic effects of climate change will be felt (well) beyond the traditional horizons of most (financial) actors

Proposed geological epoch dating from the commencement of significant human impact on Earth's geology and ecosystems, including, but not limited to, anthropogenic climate change

- Start date range: i) Agricultural Revolution 12,000–15,000 years ago, ii) peak in radionuclides fallout from atomic bomb testing in 1950s
- September 2021: formally proposed to International Commission on Stratigraphy (ICS) locating markers to the time period coinciding with the Great Acceleration, and the Atomic Age.
- Ratification process ongoing, date yet to be decided



maxresdefault.jpg (1280×720) (ytimg.com)



surgery-header.jpg (1100×385) (utmb.edu)



Terraforming:

The Diavik diamond mine, Canada (Rio Tinto)

[Largest Mines in the World \(911metallurgist.com\)](https://www.911metallurgist.com)



2.4 million



A 1991 study by the International Physicians for the Prevention of Nuclear War (IPPNW) predicted that some **2.4 million** people would eventually die from cancer as a result of atmospheric testing globally.

75 YEARS LATER, NUCLEAR WEAPONS STILL KILL | Geneva Centr...
www.gcsp.ch/global-insights/75-years-later-nuclear-weapons-still-kill

Trinity was the code name of the first detonation of a nuclear device. It was conducted by the United States Army at 5:29 a.m. on July 16, 1945, as part of the Manhattan Project.

Earth overshoot day

- Date humanity's resource consumption for year exceeds Earth's capacity to regenerate those resources that year.
- "Overshoot" represents level by which human population exceeds sustainable amount of resources
- Day in which humanity enters environmental **deficit spending**

world biocapacity

(the amount of natural resources generated by Earth that year)

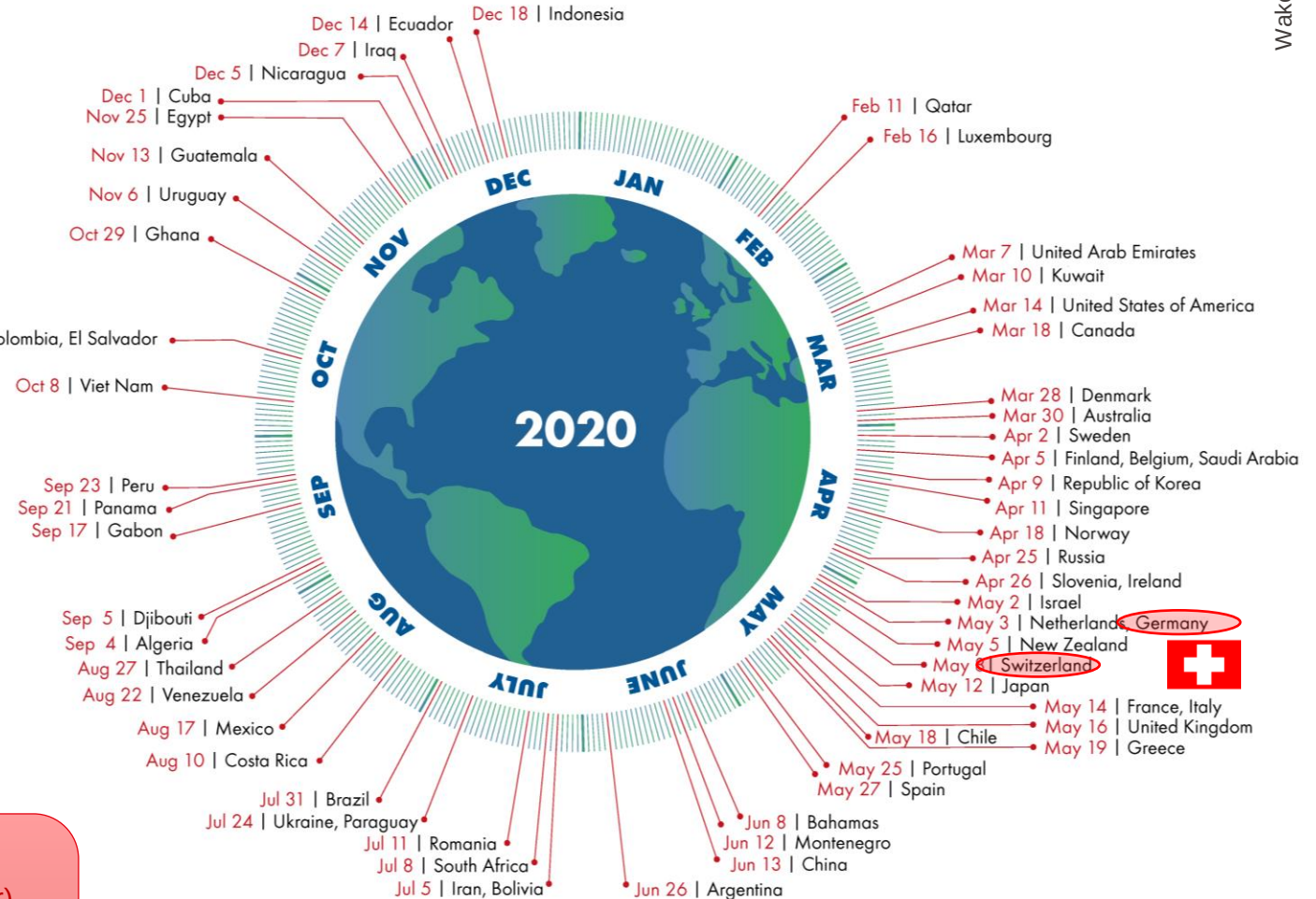
EOD =

world ecological footprint

(humanity's consumption of Earth's natural resources for that year), and multiplying by 365, the number of days in a year.

Country Overshoot Days 2020

When would Earth Overshoot Day land if the world's population lived like...



Source: Global Footprint Network National Footprint and Biocapacity Accounts 2019

Doughnut economic model ... to life buoy economy?

- Ecological ceiling (and boundaries)
- Social foundation (and shortfalls)
- Need the safe and just space between these social and planetary boundaries
- Humanity's 21st century goal

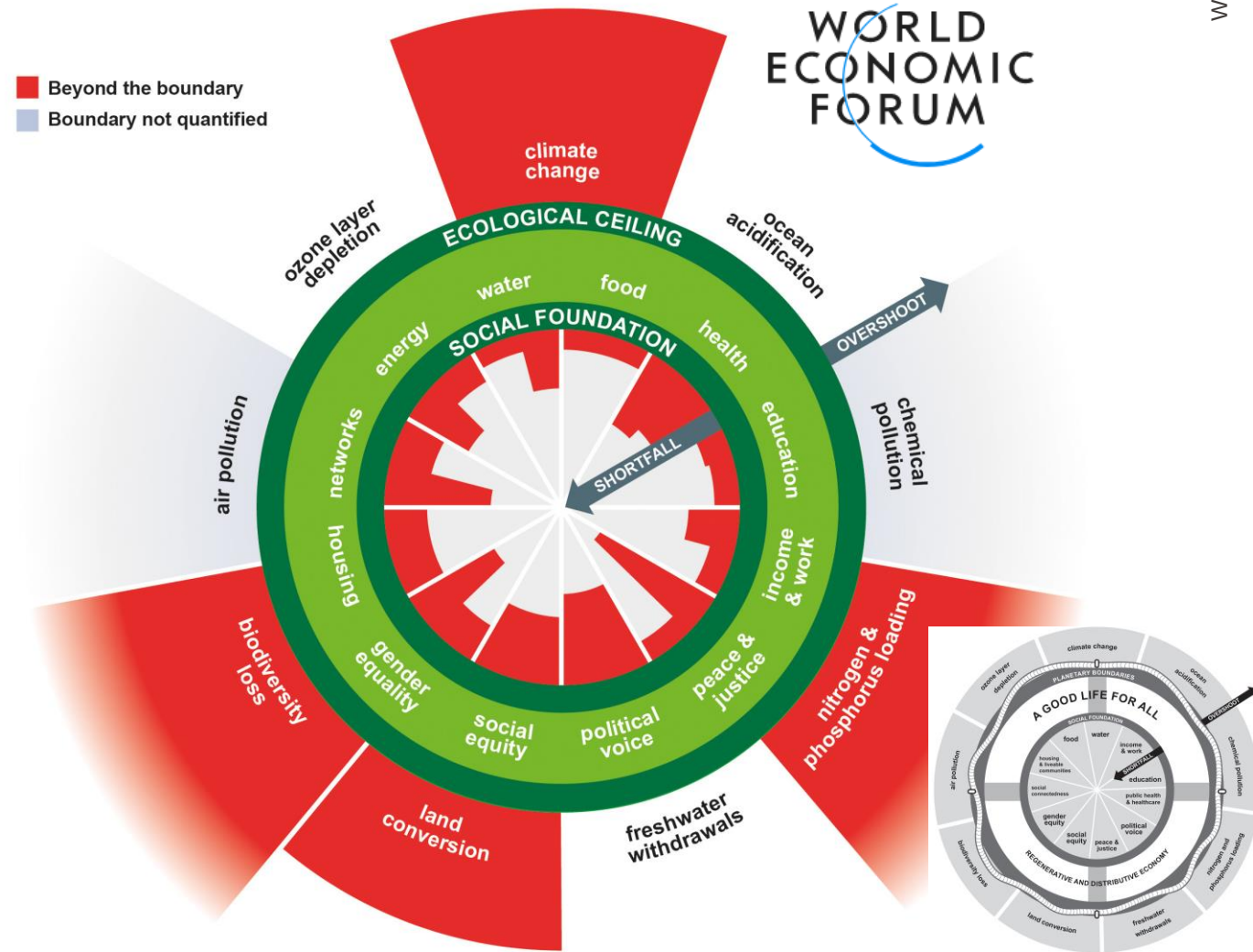


Image: Kate Raworth and Christian Guthrie/The Lancet Planetary Health

Richest 1% own half the world's wealth, study finds

Credit Suisse report highlights increasing gap between the super-rich and the remainder of the globe's population



▲ The Credit Suisse report found 2.3 million new dollar millionaires were created over the past year, taking the total to 36 million. Photograph: Carl Court/Getty Images

The globe's richest 1% own half the world's wealth, according to a new report highlighting the growing gap between the super-rich and everyone else.

World's 26 richest people own as much as poorest 50%, says Oxfam

Charity calls for 1% wealth tax, saying it would raise enough to educate every child not in school



▲ The Oxfam report says that between 2017 and 2018 a new billionaire was created every two days. Photograph: Bloomberg via Getty Images

The growing concentration of the world's wealth has been highlighted by a report showing that the 26 richest billionaires own as many assets as the 3.8 billion people who make up the poorest half of the planet's population.

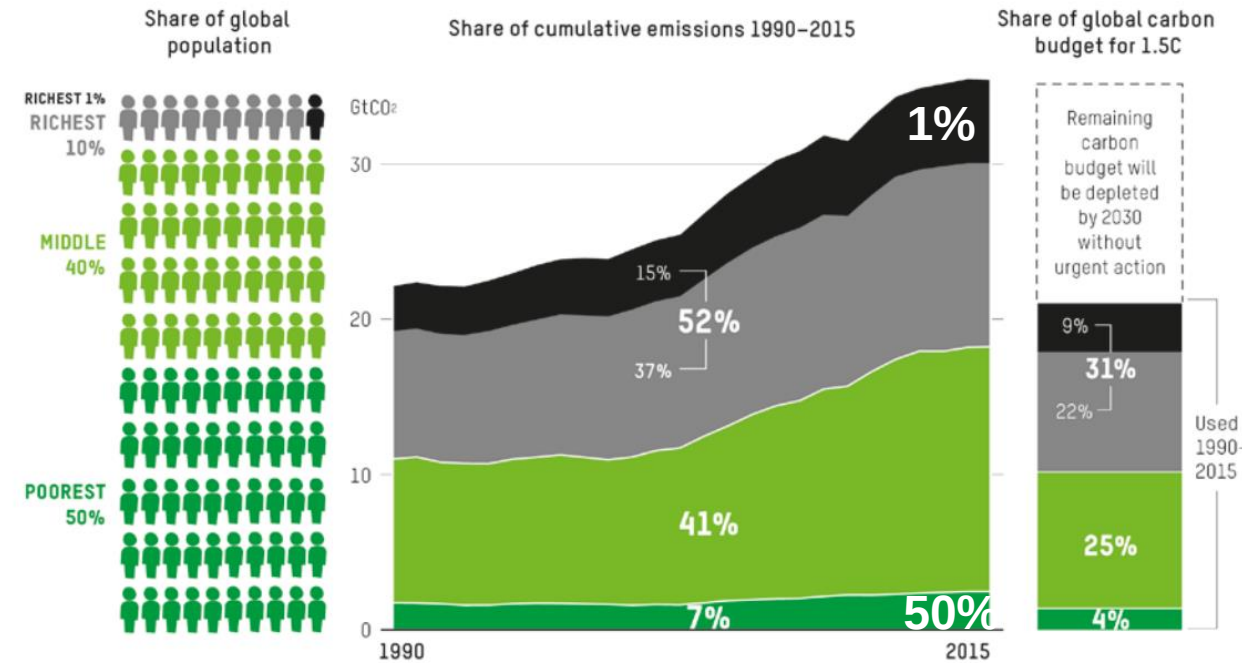
- The richest **1%** of the world have used two times as much carbon as the poorest **50%** of the population over the last 25 years



Figure 5: Main categories of consumption among highest emitters in the EU (2010)³⁰



Figure 1: Share of cumulative emissions from 1990 to 2015 and use of the global carbon budget for 1.5C linked to consumption by different global income groups



Per capita income threshold (SPPP2011) of richest 1%: \$109k; richest 10%: \$38k; middle 40%: \$6k; and bottom 50%: less than \$6k. Global carbon budget from 1990 for 33% risk of exceeding 1.5C: 1,205Gt.

Carbon emissions correlate to wealth

‘As Oxfam's new report shows,

**Our current (neo-liberal) economic model has
been an enabler of catastrophic climate
change and equally catastrophic inequality.**

COVID-19 pandemic provides an incontestable imperative to rebuild better and place the global economy on a more sustainable, resilient and fairer footing.

**Addressing the disproportionate carbon emissions from the wealthiest in
society must be a key priority as part of this collective commitment.’**



Ban Ki-moon,
Deputy Chair of
The Elders, former
Secretary-General
of the United
Nations

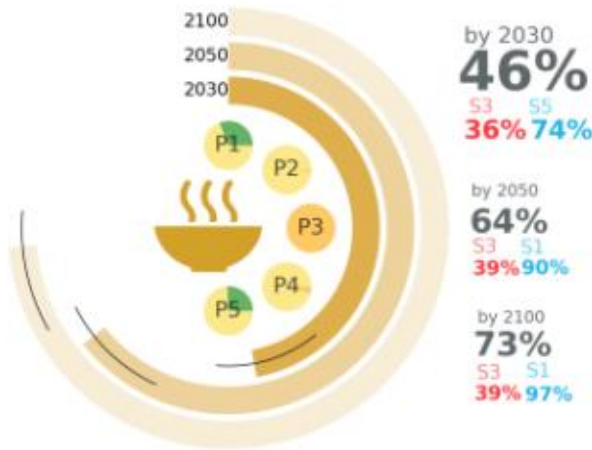
UN 2030 sustainable development goals



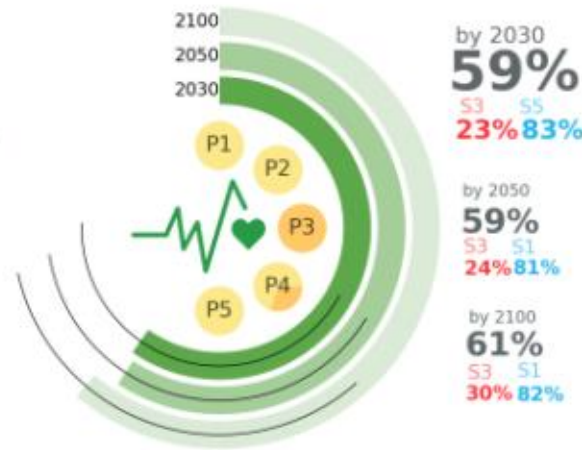
[Transforming our world: the 2030 Agenda for Sustainable Development | Department of Economic and Social Affairs \(un.org\)](#)

SDG progress

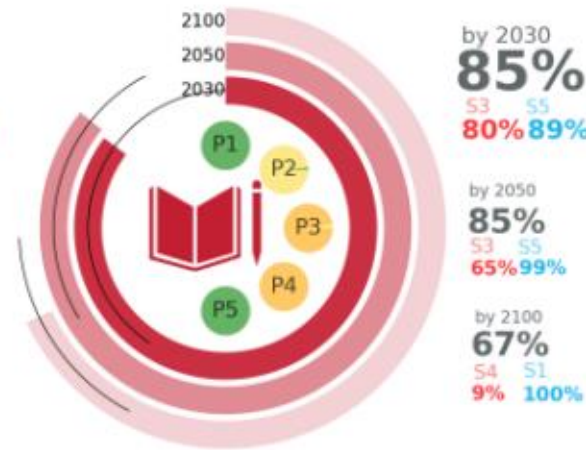
Countries are making incremental progress on strengthening their NDCs, but what we really need to achieve the goals of the Paris Agreement is urgent transformational change.



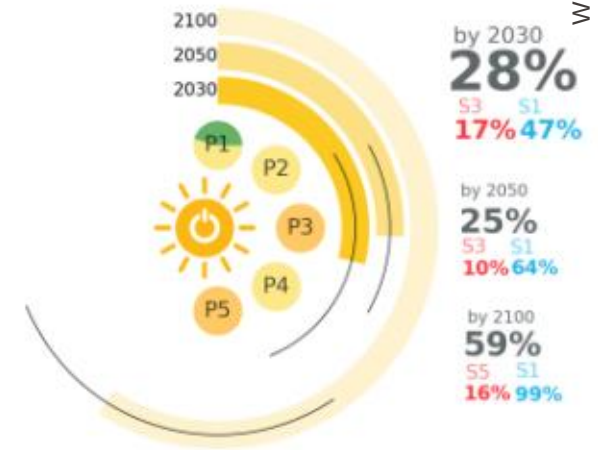
Sustainable Food



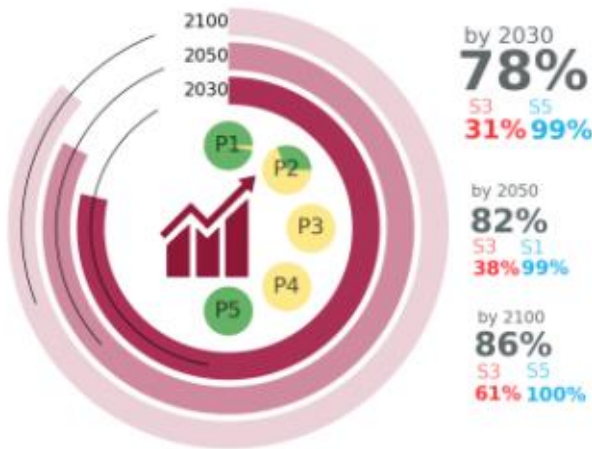
Health & Well-being



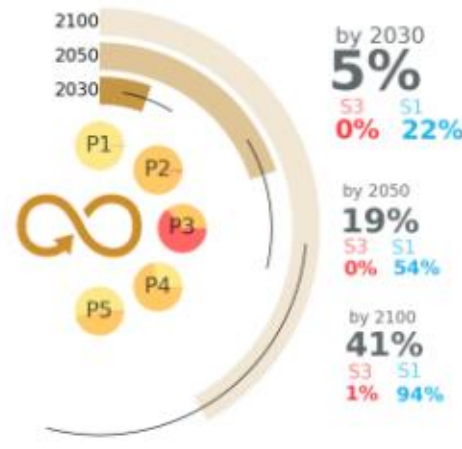
Quality Education



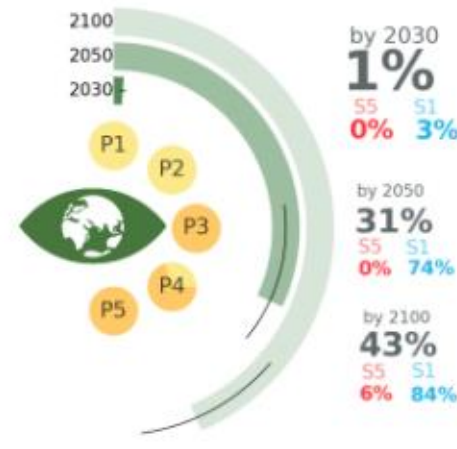
Clean Energy



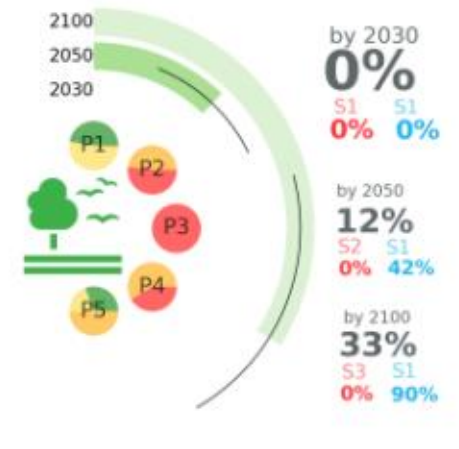
Economic Growth



Responsible Production



Climate Action

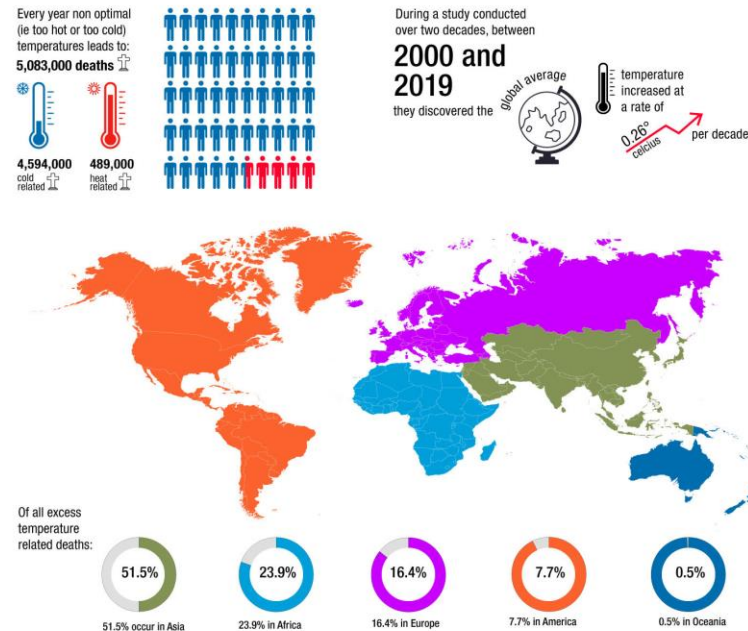


Biodiversity Conservation

Our current Petro-chemical economy, diet, & human health

- ~ 15 million / yr of our own cause
 - Air pollution: 7 million, of which 3.6 million fossil fuel
 - Obesity: 2.8 million
 - Temperature: 5 million from excessive temperatures
- Around same as Covid-19: 14.9 million excess deaths in 2020 and 2021

World's largest study of global climate related mortality



[how many people die from air pollution](#)

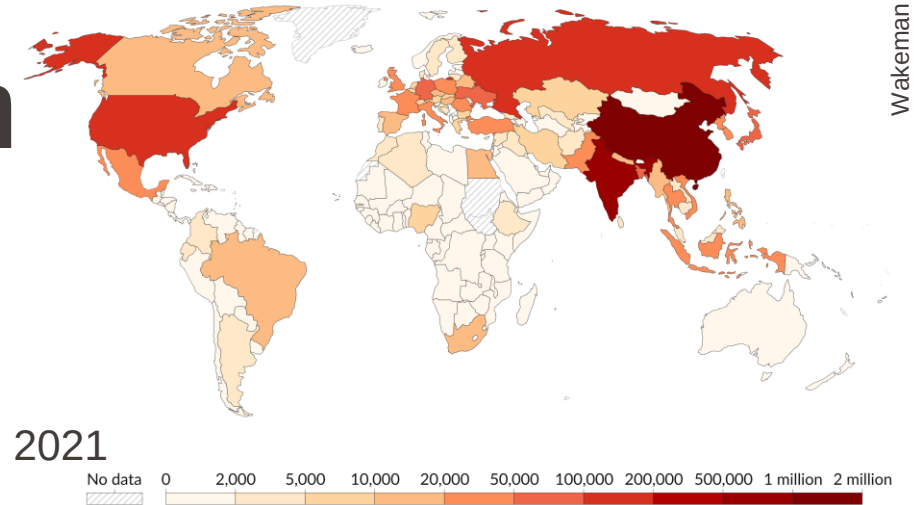
[Obesity \(who.int\)](#)

[global climate related mortality 5 million deaths a year to abnormal temperatures](#)

[COVID-19 pandemic \(who.int\)](#)

Air pollution deaths from fossil fuels, 2015

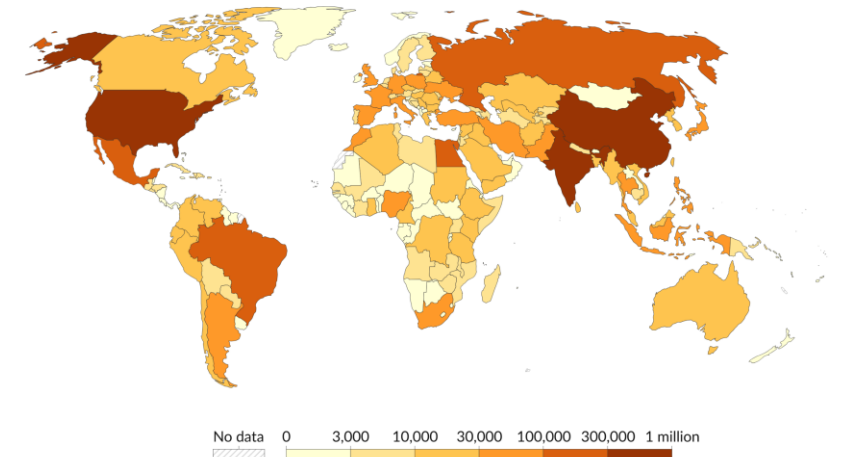
This measures annual excess mortality from the health impacts of air pollution from fossil fuels.



Data source: Lelieveld et al. (2019). Effects of fossil fuel and total anthropogenic emission removal on public health and climate. PNAS. OurWorldinData.org/air-pollution | CC BY

Deaths due to obesity, 2021

Estimated annual number of deaths attributed to obesity¹.



Data source: IHME, Global Burden of Disease (2024)

Note: Obesity is defined as having a body-mass index (BMI) ≥ 30 . BMI is a person's weight (in kilograms) divided by their height (in meters) squared.

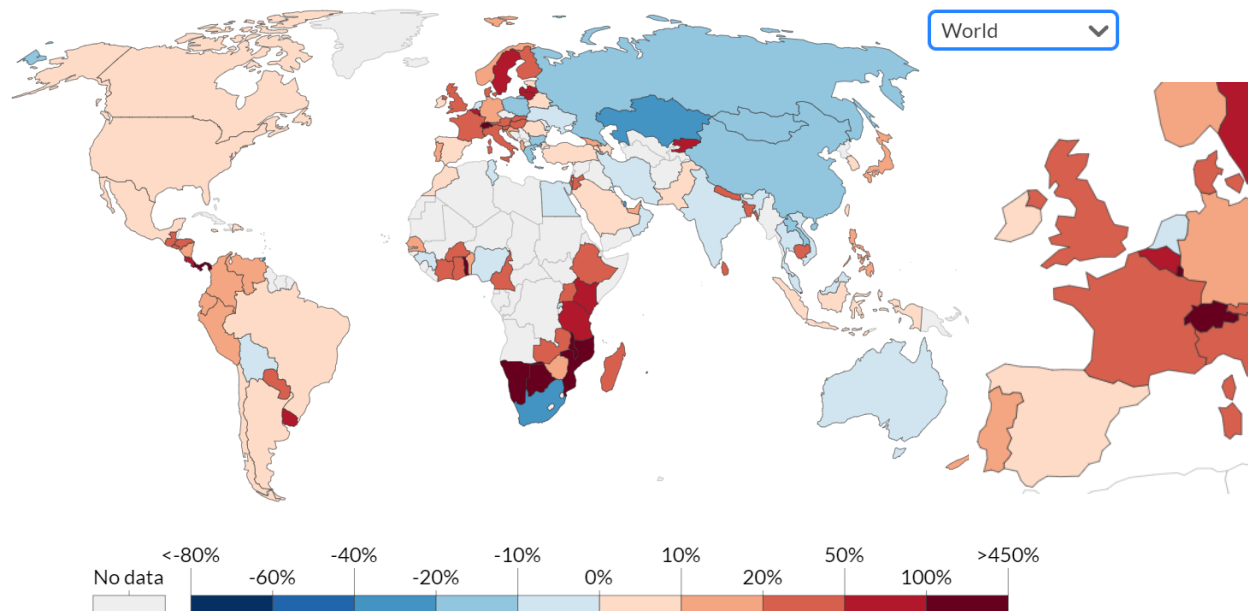
1. **Obesity:** Obesity is defined as having a body-mass index (BMI) above 30. A person's BMI is calculated as their weight (in kilograms) divided by their height (in meters) squared. For example, someone measuring 1.60 meters and weighing 64 kilograms has a BMI of $64 / 1.6^2 = 25$. Obesity increases the mortality risk of many conditions, including cardiovascular disease, gastrointestinal disorders, type 2 diabetes, joint and muscular disorders, respiratory problems, and psychological issues.

Key issues for Switzerland

- Net importers of CO₂
- High standard of living & wealth drive consumption based CO₂ emissions

CO₂ emissions embedded in trade, 2018

Share of carbon dioxide (CO₂) emissions embedded in trade, measured as emissions exported or imported as the percentage of domestic production emissions. Positive values (red) represent net importers of CO₂ (i.e. "20%" would mean a country imported emissions equivalent to 20% of its domestic emissions). Negative values (blue) represent net exporters of CO₂.

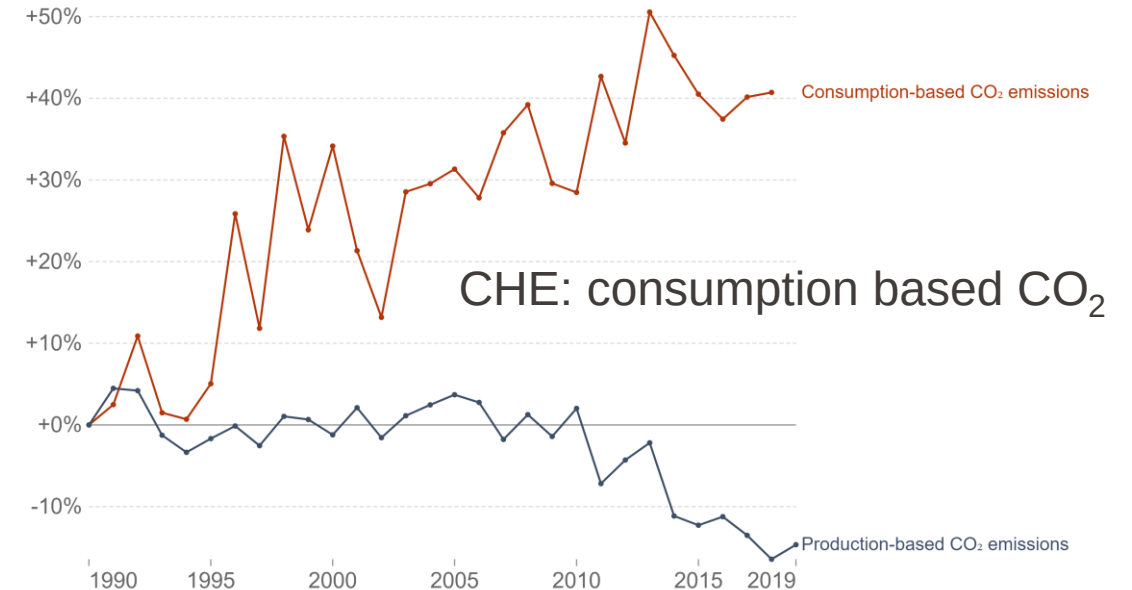


Source: Our World in Data based on the Global Carbon Project
OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY

1990 2018

Production vs. consumption-based CO₂ emissions, Switzerland

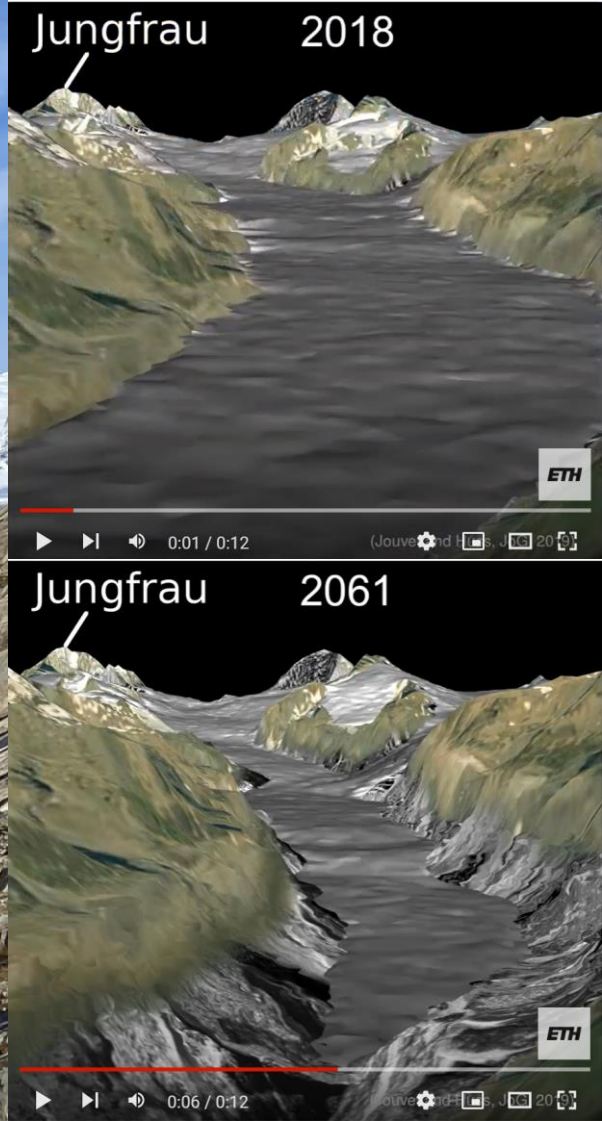
Annual consumption-based emissions are domestic emissions adjusted for trade. If a country imports goods the CO₂ emissions needed to produce such goods are added to its domestic emissions; if it exports goods then this is subtracted.



Source: Global Carbon Project

OurWorldInData.org/co2-and-other-greenhouse-gas-emissions/ • CC BY
Note: This measures CO₂ emissions from fossil fuels and cement production only – land use change is not included.

Shifting baseline syndrome (Daniel Pauly in 1995)



Negative externalities



125 M CHF clean up cost (700 CHF/working person in Valais)

SWI swissinfo.ch

Swiss perspectives in 10 languages

Swiss Alps Slammed by More Severe Flooding, Landslides

June 30, 2024 - 19:36

2 minutes

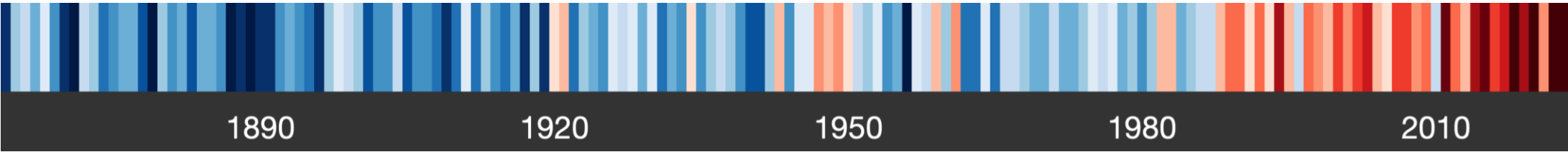
menu

RTS

Info Sport Culture



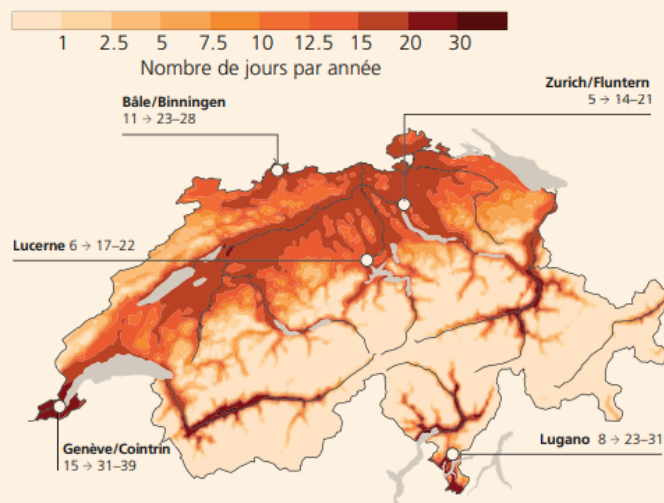
MSE-440



#ShowYourStripes

Évolution du nombre de journées tropicales

Évolution attendue du nombre de jours avec des températures supérieures à 30 degrés Celsius vers 2060 par rapport à 1981–2010 (moyenne sur 30 ans) sans mesures de protection du climat. Les valeurs correspondent à la période de référence 1981–2010 et les changements possibles vers 2060.



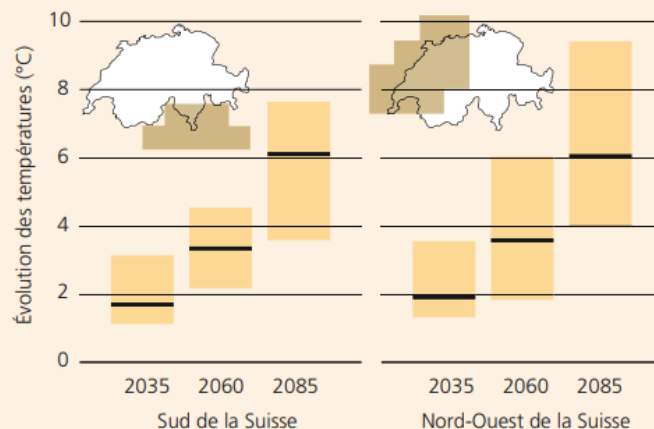
Plus de journées tropicales

Les régions urbaines situées à basse altitude seront particulièrement touchées par des canicules. Sur le Plateau et dans les vallées alpines, le thermomètre grimpera plus fréquemment au-dessus de la barre des 30 degrés Celsius qui caractérise une « journée tropicale ». On attend le plus grand nombre de journées tropicales supplémentaires pour les régions de Genève, du Valais et du Sud de la Suisse.

Évolution des températures maximales annuelles

Évolution moyenne vers 2035, 2060 et 2085 par rapport à la période de référence 1981–2010 (moyenne sur 30 ans) sans mesures de protection de climat.

— Valeur attendue (valeur médiane de l'ensemble des simulations)
 ■ Valeurs possibles (plage des valeurs possibles sur l'ensemble des simulations)



Les températures maximales augmenteront particulièrement

Les températures maximales annuelles augmenteront fortement. D'ici le milieu du siècle, le jour le plus chaud de l'année pourra atteindre jusqu'à 4 degrés Celsius de plus au Sud des Alpes et même jusqu'à 6 degrés Celsius de plus au Nord des Alpes par rapport à aujourd'hui. À Genève, par exemple, le jour le plus chaud d'une année moyenne pourrait atteindre environ les 40 degrés Celsius.

Median

+4°C Lausanne 2060

+6°C Lausanne 2085
(my Kids)

Briefing

Jul 24th 2021 edition >

What's the worst that could happen

Three degrees of global warming is quite plausible and truly disastrous

Rapid emission cuts can reduce the risks but not eliminate them



Three degrees of global warming is quite plausible and truly disastrous | The Economist

Flight, fight, or freeze

- Aim is to help you fight
- Not freeze in data overload
- Not run away and ignore the issue



[peter rabbit GIF \(giphy.com\)](https://giphy.com/peter-rabbit)

slido



Why do we need a circular economy?

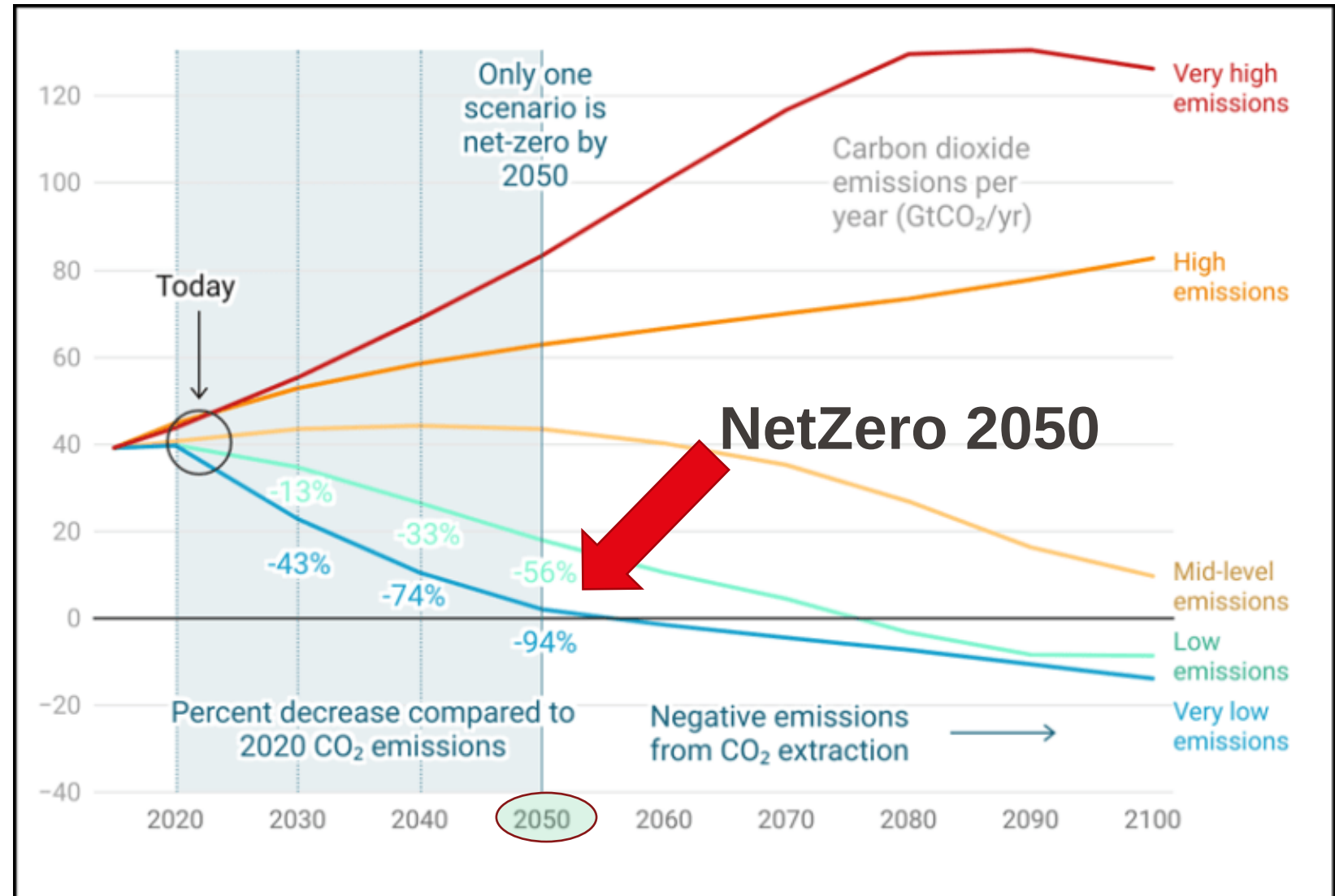
① Start presenting to display the poll results on this slide.

- Sustainability
- NetZero transition
- Linear vs. circular economy
- Circular economy frameworks
- Materials and engineered product examples
- Enablers to a CE
- Initiatives

Requires sharp CO₂ cuts per decade, net zero CO₂ by 2050, and carbon capture.

Needs systemic change.

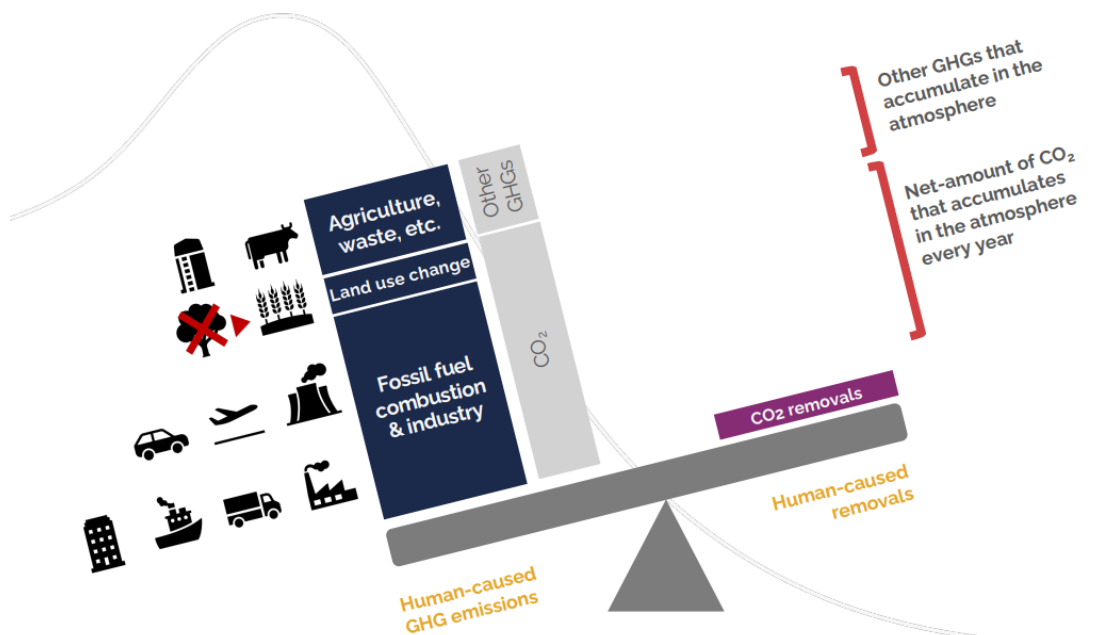
- In industry
- In government
- In academia
- In our own lives



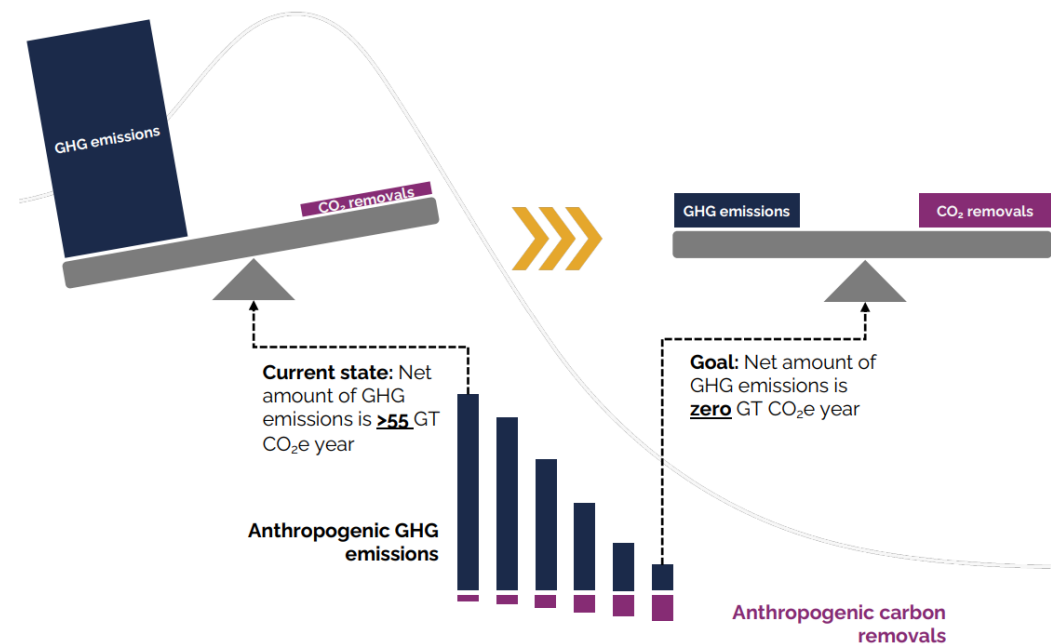
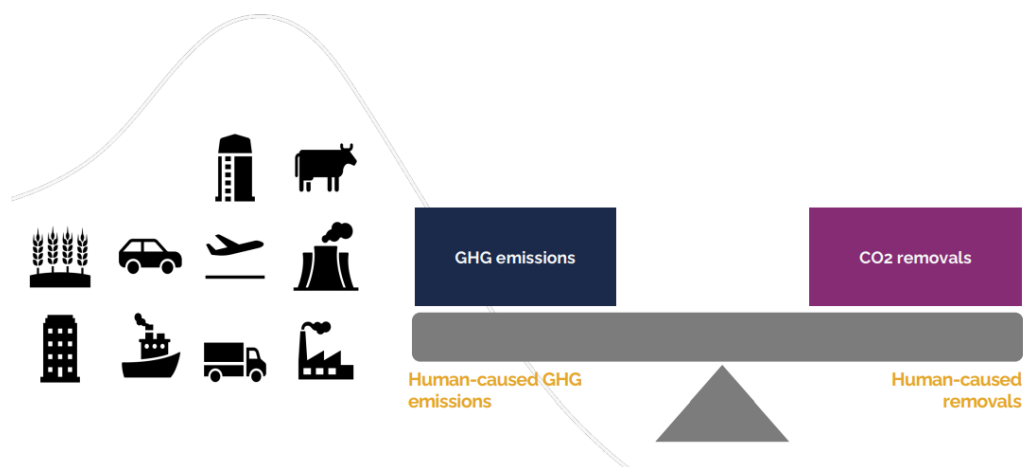
Credit: Jenessa Duncombe.
Source: IPCC [2021]

[What Five Graphs from the U.N. Climate Report Reveal About Our Path to Halting Climate Change - Eos](#)

Towards a net-zero economy



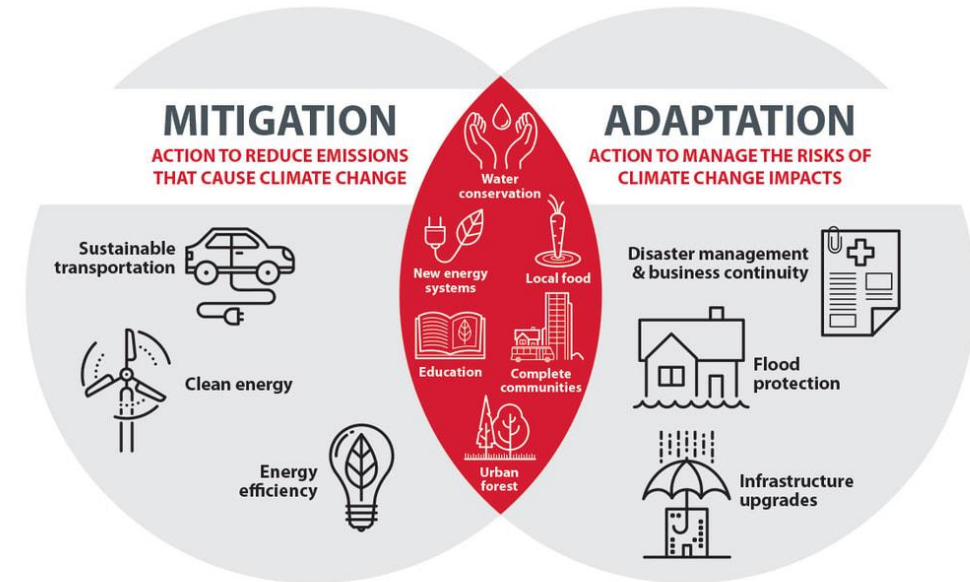
To limit global warming to 1.5°C, we must reach net-zero carbon emissions **no later than 2050.**



Mitigation versus adaptation

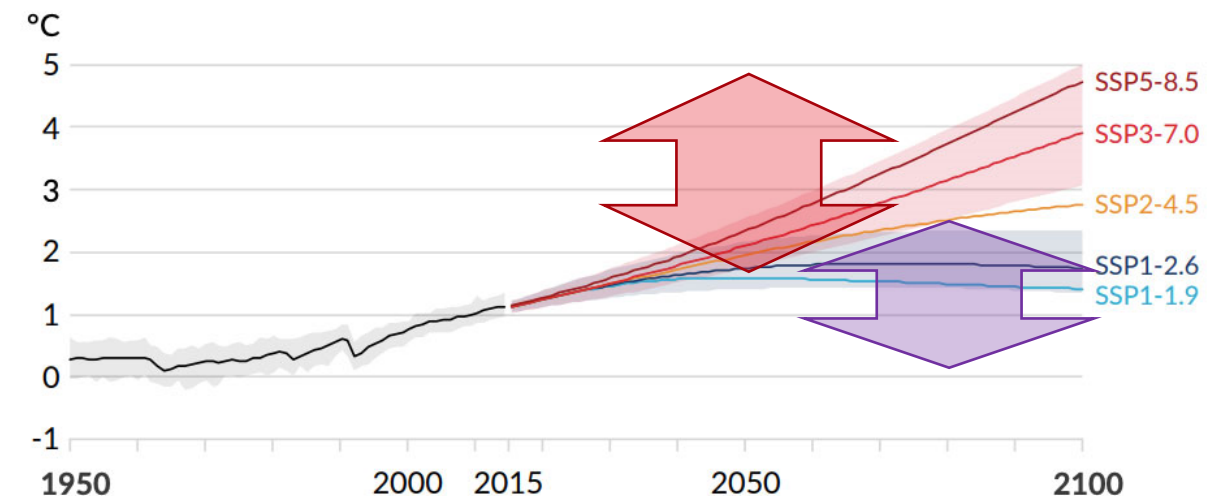
- Mitigation and adaptation are two different approaches to deal with climate change.
- **Mitigation** refers to the efforts to **reduce** greenhouse gas emissions (abatement) and slow the rate of climate change.
- **Adaptation** refers to the efforts to **adjust** to the current and future effects of climate change.
- Mitigation tackles the causes of climate change, whereas adaptation tackles the effects.

Building Climate Resilience



ESS Topic 7.3: Climate change – Mitigation and Adaptation - AMAZING WORLD OF SCIENCE WITH MR.

a) Global surface temperature change relative to 1850-1900



Sixth Assessment Report — IPCC

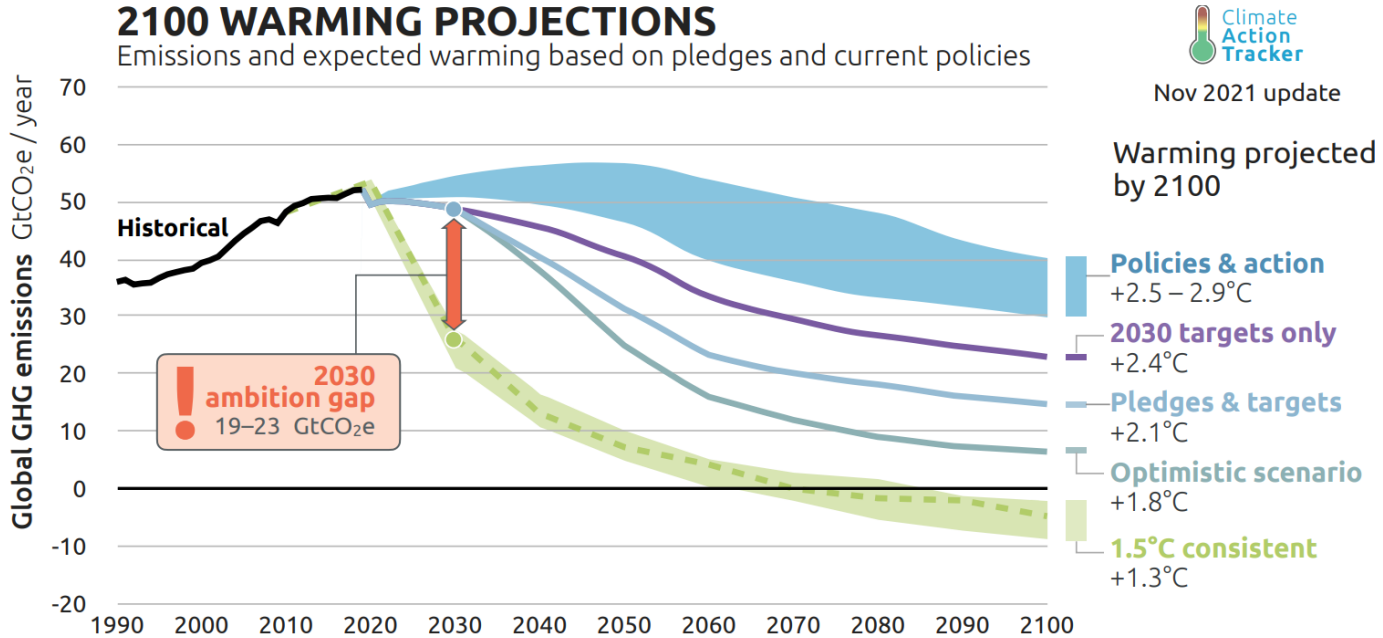
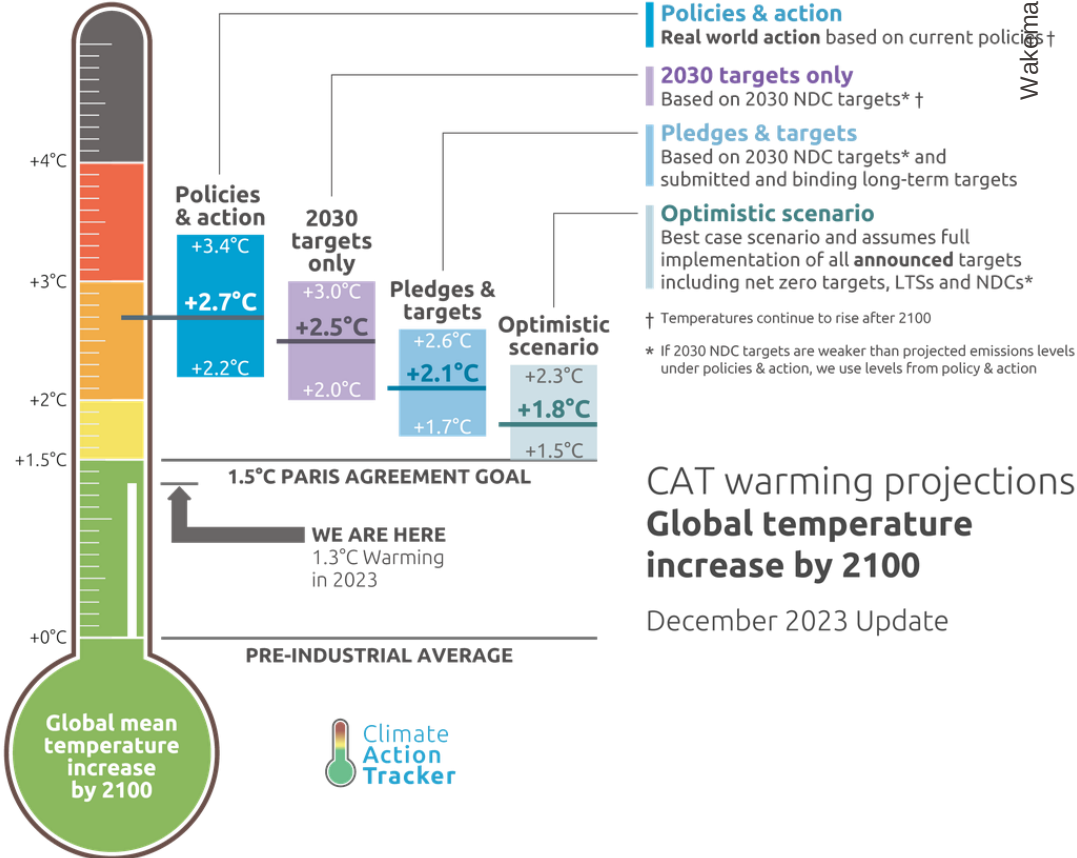


Figure 2 Global greenhouse gas emission pathways for CAT estimates of policies and action, 2030 targets only, 2030 and binding long-term targets and an optimistic pathway based on net zero targets of over 140 countries in comparison to a 1.5°C consistent pathway.

Leaves a remaining carbon budget
 Σ anthropogenic CO₂e that can still be emitted into the atmosphere while holding the global average temperature increase to 1.5°C
200 GtCO₂ as of 2024, equal to around six years of current CO₂ emissions.



**Pledges and targets = +2.1°C;
 Policies and actions = +2.7°C**

**Weak
interaction of
NDC and the
SDGs**

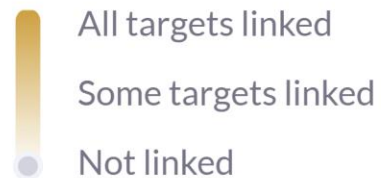
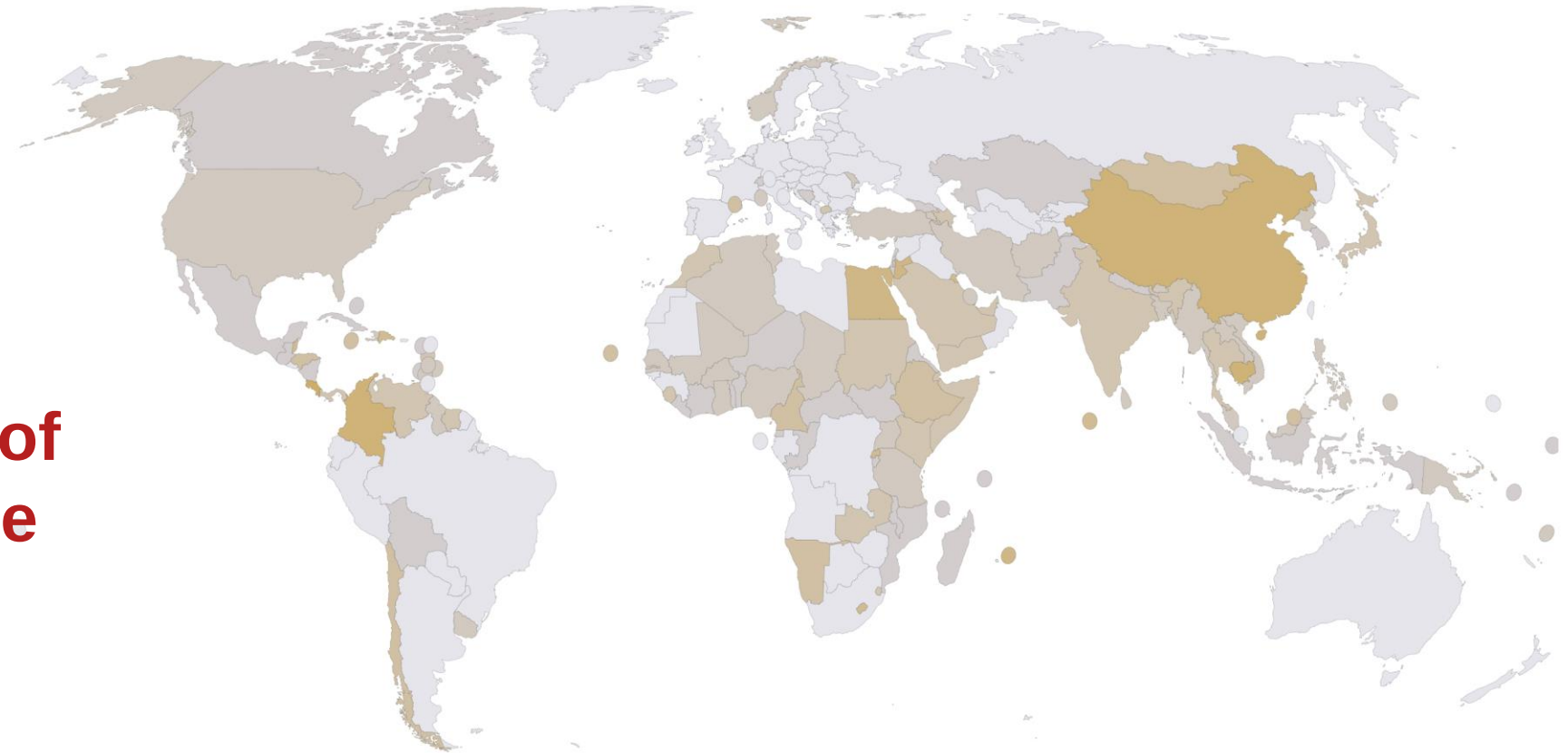
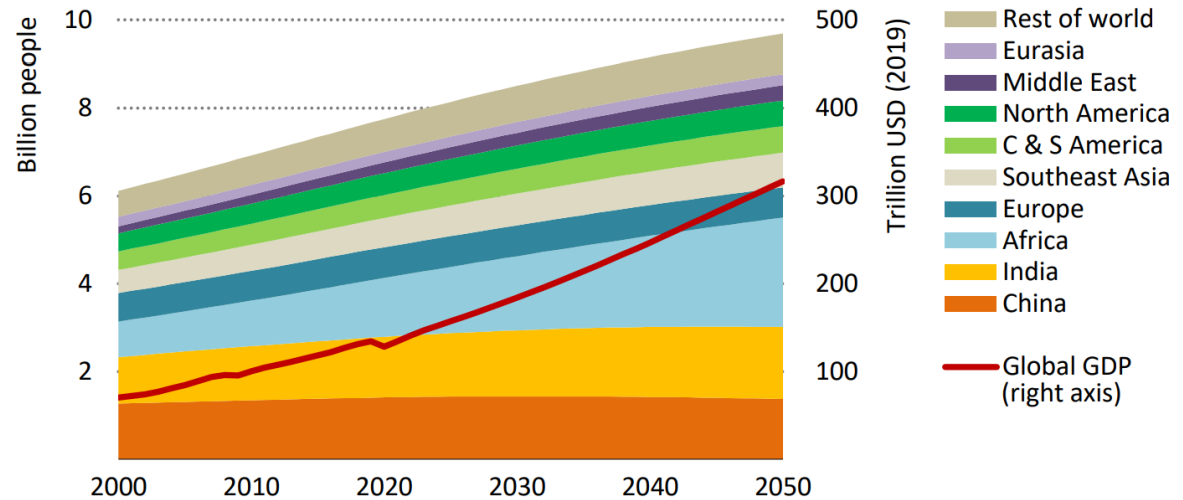


Figure 2.1 ▶ World population by region and global GDP in the NZE



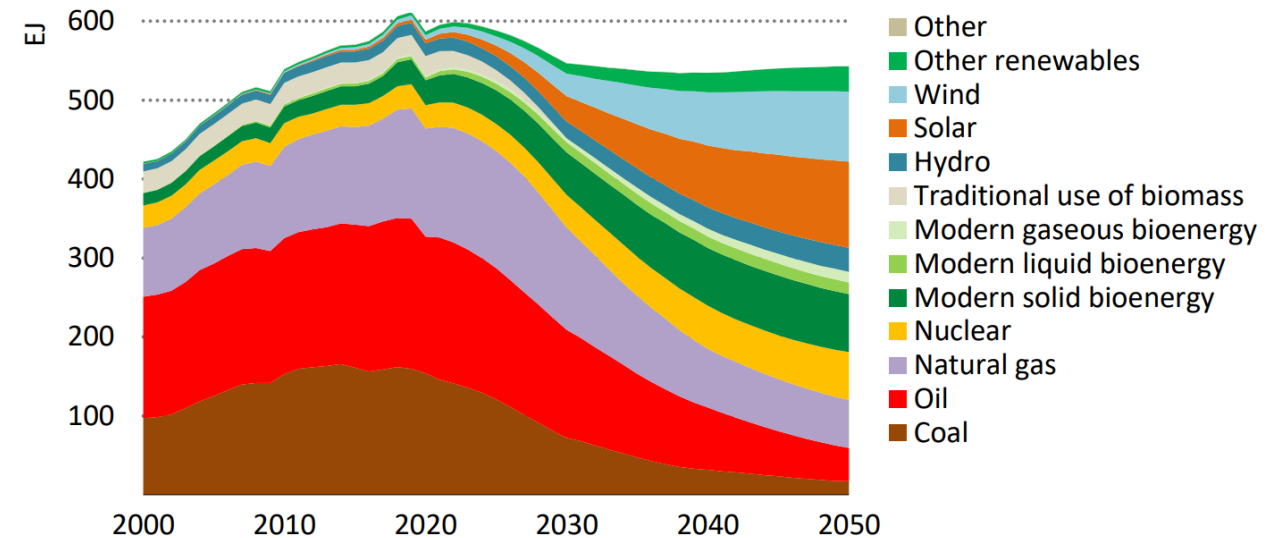
IEA. All rights reserved.

*By 2050, the world's population expands to 9.7 billion people
and the global economy is more than twice as large as in 2020*

Notes: GDP = gross domestic product in purchasing power parity; C & S America = Central and South America.

Sources: IEA analysis based on UNDESA (2019); Oxford Economics (2020); IMF (2020a, 2020b).

Figure 2.5 ▶ Total energy supply in the NZE



IEA. All rights reserved.

*Renewables and nuclear power displace most fossil fuel use in the NZE,
and the share of fossil fuels falls from 80% in 2020 to just over 20% in 2050*



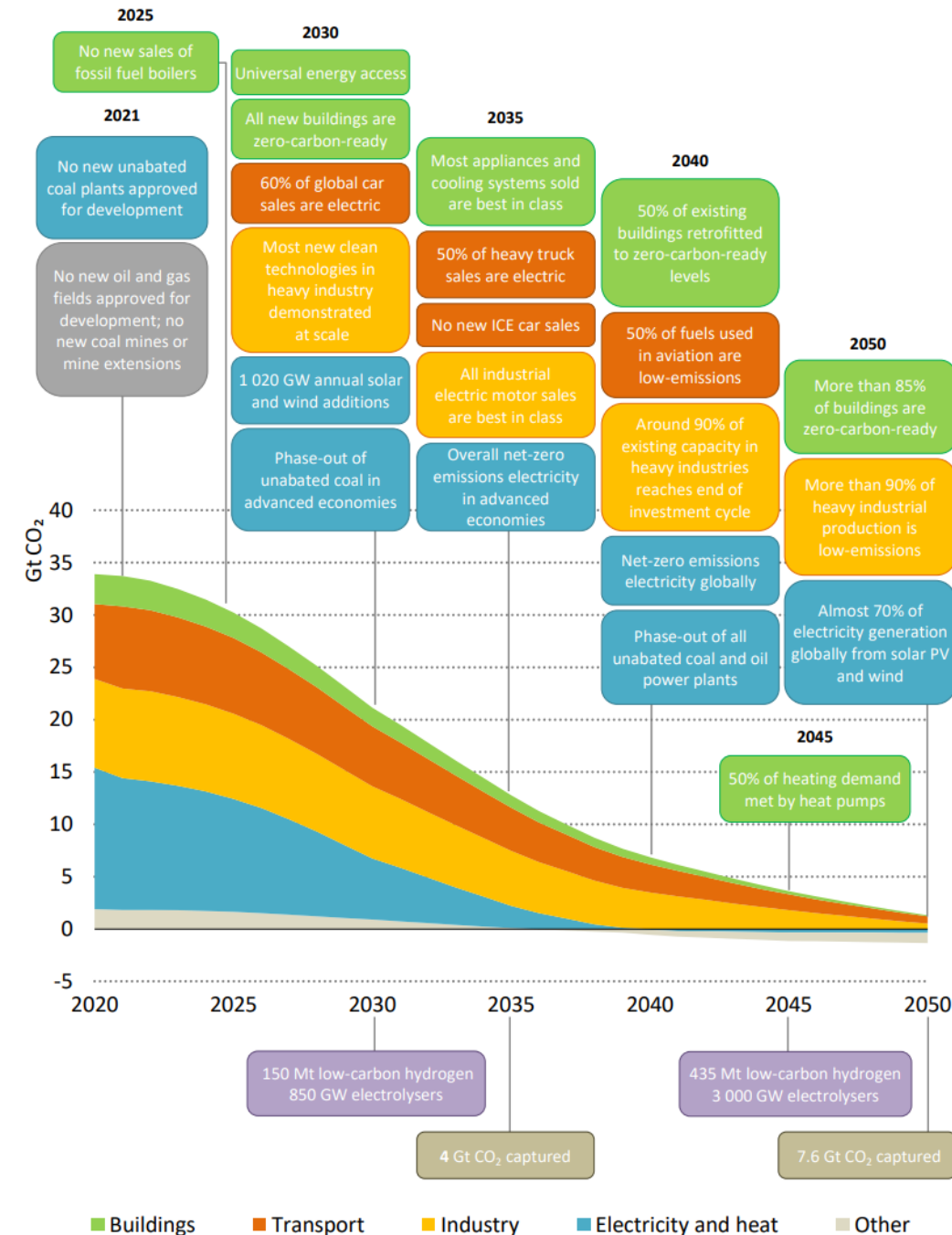
NetZero 2050 milestones

- 2030
 - 1TW/yr annual solar and wind additions
 - Automakers plan to build 54 million battery electric vehicles
 - >50% of total vehicle production
 - Investment of \$1.2 trillion
- 2035
 - world's first zero-emission commercial aircraft
 - Net-zero electricity generation in EU
- 2040
 - 39,000 new passenger & freighter aircraft
 - Coal & oil power phased out
- 2050
 - 2x automobiles, 86% electric
 - 70% power solar, PV, and wind

[Exclusive: Automakers to double spending on EVs, batteries to \\$1.2 trillion by 2030 | Reuters](#)

[Net Zero by 2050 - A Roadmap for the Global Energy Sector](#)

Key milestones in the pathway to net zero

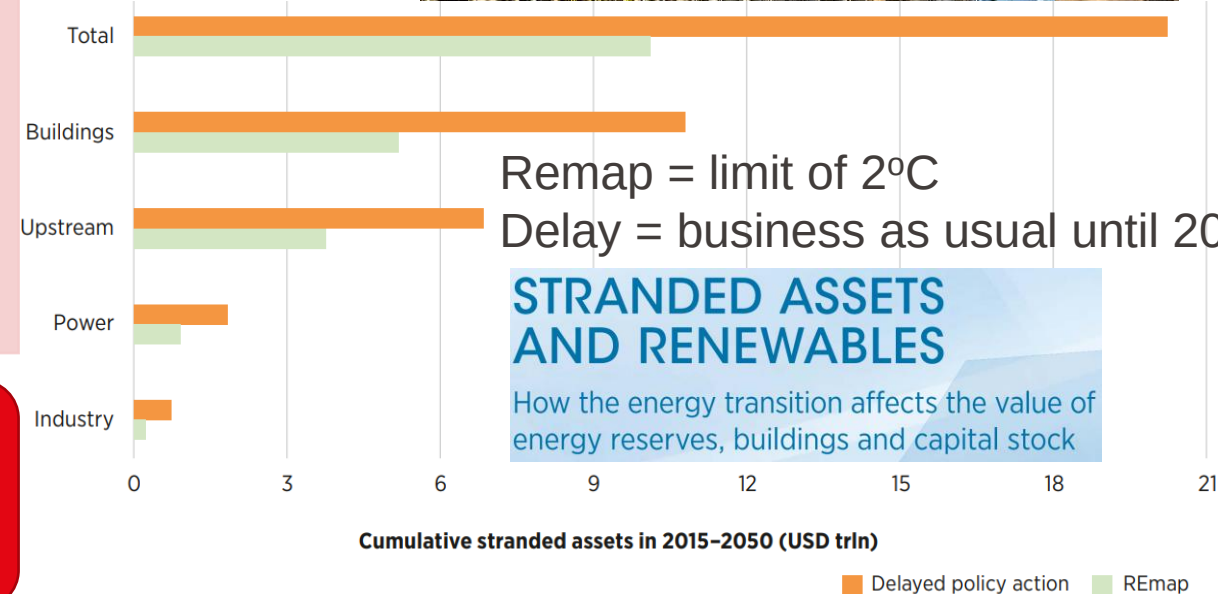


Stranded Assets

- Big issue in industrial world
- e.g. EVs and power generation (coal)
- Significant assets in place
- Long payback period
- Difficult to change course, but then big impact
- Time needed to put new CAPEX investments in place is an urgent issue
 - clean power, energy efficient plant, urban environment, new ways of making materials, EV infrastructure ...

- **Stranded assets: redundant before end of usual operational life**
- **Value = 10-20T\$ by 2050**

1981_BASF_YPC_Company_Limited
_in_Nanjing.jpg (3189x2126)
(plastverarbeiter.de)



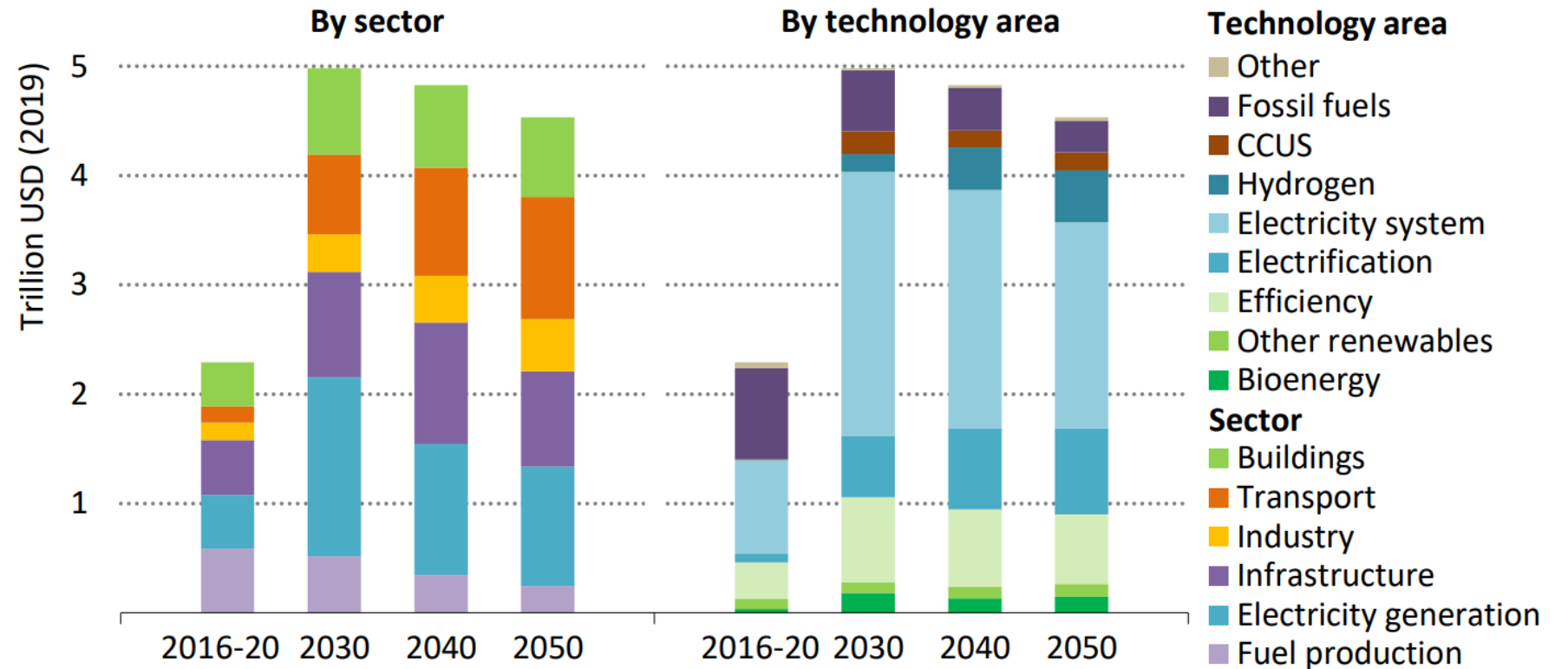
Stranded Assets and Renewables: How the energy transition affects the value of energy reserves, buildings and capital stock - a REmap working paper (ourenergypolicy.org)

Figure 2.22 ▶ Annual average capital investment in the NZE

Growth creating
(and changing)
employment

- Transport
- Electrification
- Hydrogen
- Infrastructure

7.5% GDP more
likely



IEA. All rights reserved.

Capital investment in energy rises from 2.5% of GDP in recent years to 4.5% by 2030; the majority is spent on electricity generation, networks and electric end-user equipment

Investment needed to reach NetZero

- \$275 trillion of cumulative spending on physical assets
- Equivalent to 7.5% of GDP from 2021 to 2050.”
- In 2020 terms:
 - 50% global corporate profits
 - 1/4 of total tax revenue
 - 15% gross fixed capital formation
 - 7% percent of household spending.
- Or 3-4x covid effort each year

McKinsey
Sustainability

[A net-zero economy: The impact of decarbonization | McKinsey](#)

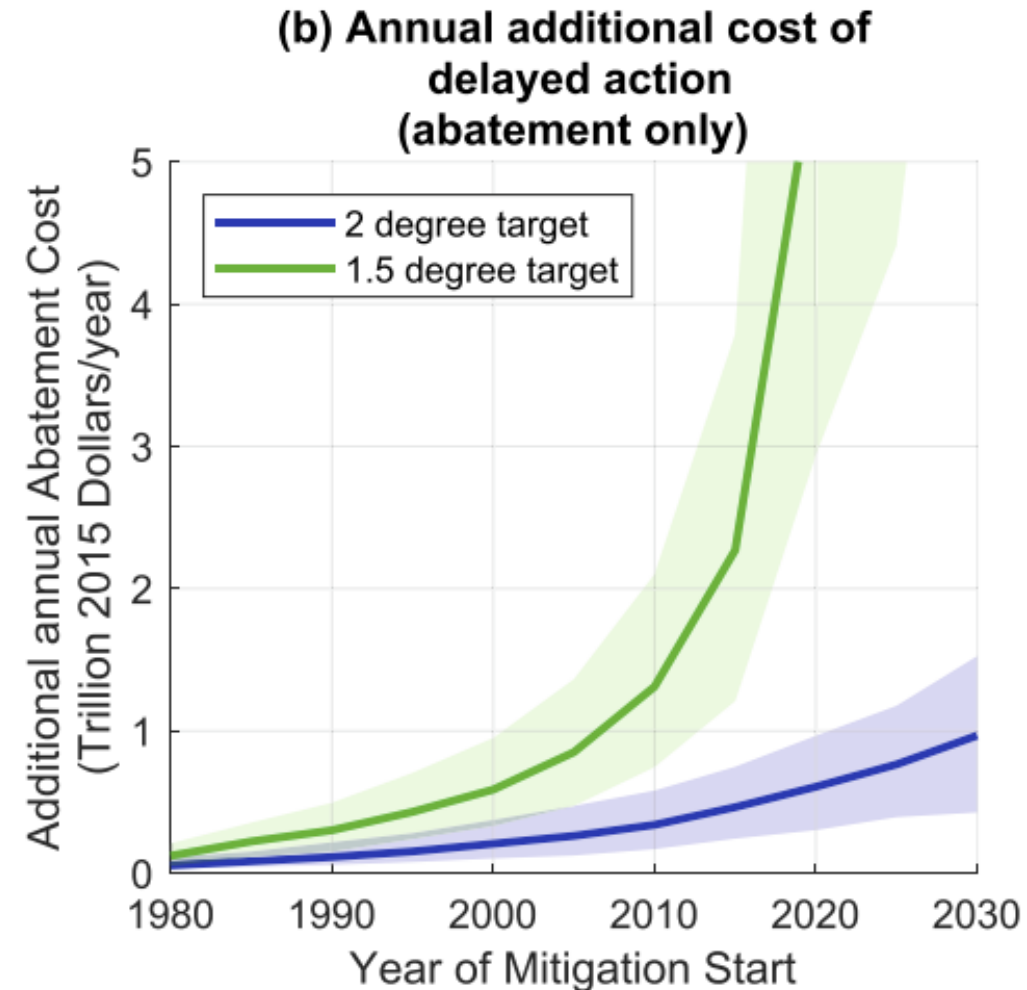
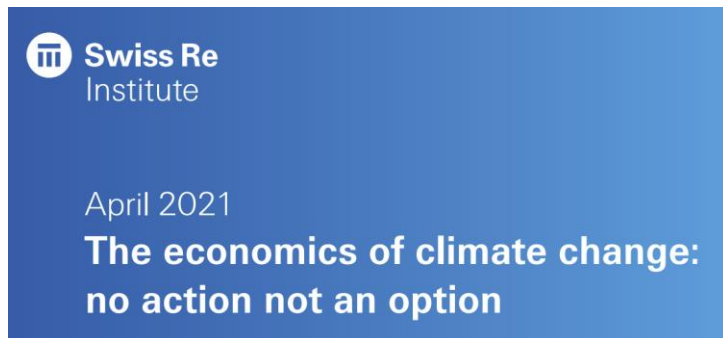


[The Best Investment You Can Make | HuffPost Impact](#)

Cost now versus delayed action

- **Mitigation delay costs (excluding adaptation) additional 0.5(5) trillion \$/yr**
- Could lose ~ 10% of total economic value by mid-century if climate change stays on current trajectory

(Paris Agreement and 2050 net-zero emissions targets are not met)



Excludes adaptation

[Assessing the costs of historical inaction on climate change | Scientific Reports \(nature.com\)](#)

[The economics of climate change | Swiss Re](#)
[2023-incidences-economiques-rapport-pisani-5juin.pdf \(strategie.gouv.fr\)](#)

Clear business case for human health: pay back period

- The payback period for achieving net-zero emissions in terms of human health benefits ALONE is around 1 decade (10yrs)
- 1. Immediate Benefits:** reductions in air pollution, which can lead to fewer respiratory and cardiovascular diseases. Transitioning to cleaner energy sources can reduce health-related costs and improve quality of life within 1-5 years¹.
- 2. Long-Term Gains:** reduced incidence of chronic diseases linked to climate change (e.g., heat-related illnesses, vector-borne diseases), may take 10-20 years to fully materialize as the effects of climate change are mitigated².
- 3. Economic Considerations:** The economic payback from health improvements can also be significant, for every dollar invested in climate action, there can be multiple dollars saved in health costs over time³.



World ▾ Business ▾ Markets ▾ Sustainability ▾ Legal ▾ More ▾

COP26

Climate inaction costlier than net zero transition: Reuters poll

By Swathi Nair

October 25, 2021 9:16 AM GMT+2 · Updated 2 years ago

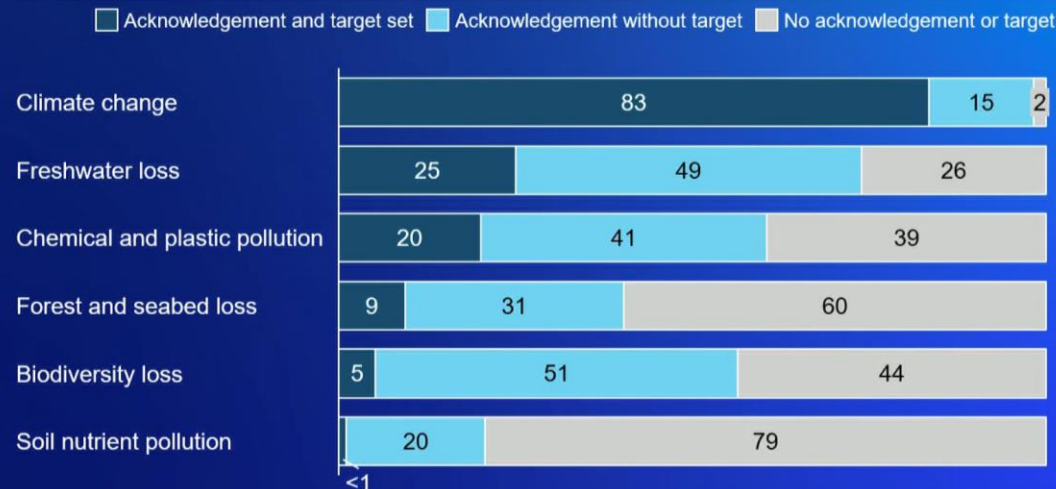


Wider metrics beyond climate change, environment and society

Redirect capital to locations which will see the strongest effects of climate change yet have contributed less towards cumulative emissions

Many global F500 clients have defined targets for climate change, but few have commitments on other dimensions of nature

Global 500 nature-related targets and acknowledgements
Percent of Global 500 companies¹



- Of the 460 F500 companies assessed ~83% **have targets defined on climate**
- Several **F500 clients care and have acknowledged nature dimensions**, though only few have committed specific targets (~5% for biodiversity)
- As clients embark on their nature goals, they will need to better assess business-specific nature risks and opportunities

¹ Includes 460 of the Global 500 companies
Source: Company websites, press search

- Sustainability
- NetZero transition
- **Linear vs. circular economy**
- Circular economy frameworks
- Materials and engineered product examples
- Enablers to a CE
- Initiatives

Enablers: NetZero 2050 transition

Effective
international
collaboration

Orderly and just
transition

Societal
behavioral
adaptation

Innovation in
new and
emerging
technologies

Transportation
transition to EVs

Petrochemical to
Bio-mass
feedstock

Renewable
energy transition

Hydrogen
economy

Agriculture,
food, diet

Sufficiency

Circular economy



[*the-net-zero-transition-what-it-would-cost-and-what-it-could-bring-final.pdf \(mckinsey.com\)](https://www.mckinsey.com/~/media/mckinsey/featured-insights/net-zero/012322-the-net-zero-transition-what-it-would-cost-and-what-it-could-bring-final.pdf)

Economics definition: “Efficient allocation of scarce resources”

- The current economic model has failed* in that resources are not efficiently allocated

Over-production



Overproduction - Lean Strategies International

Over-consumption



Overconsumption – HiSoUR – Hi So You Are

Over-trading



[How to Avoid Overtrading | by TradersAsset](#)

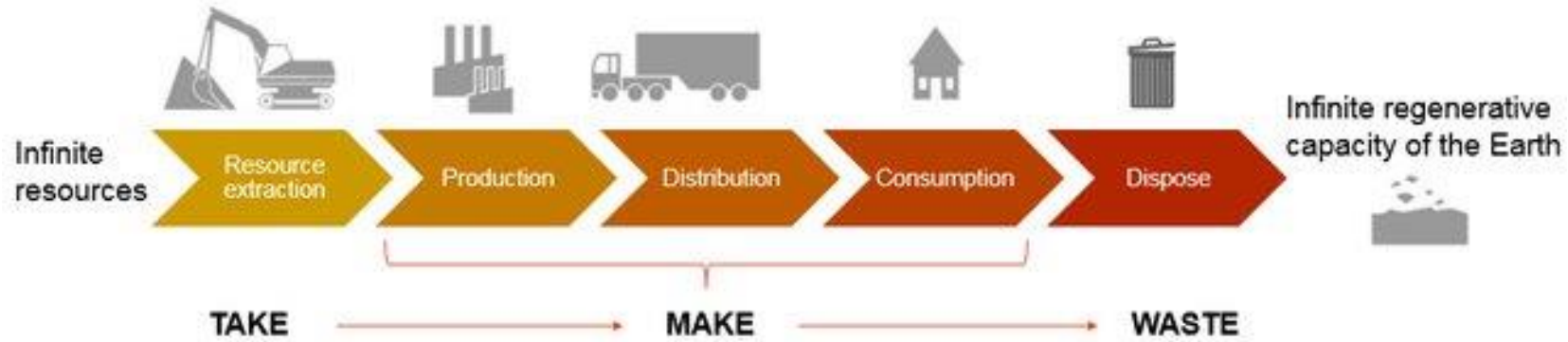
- **We need a new economic model**

* Failure means that the current system is not the optimum solution



An issue: our linear economy

- A uni-directional approach of extract, make, use, and dispose.

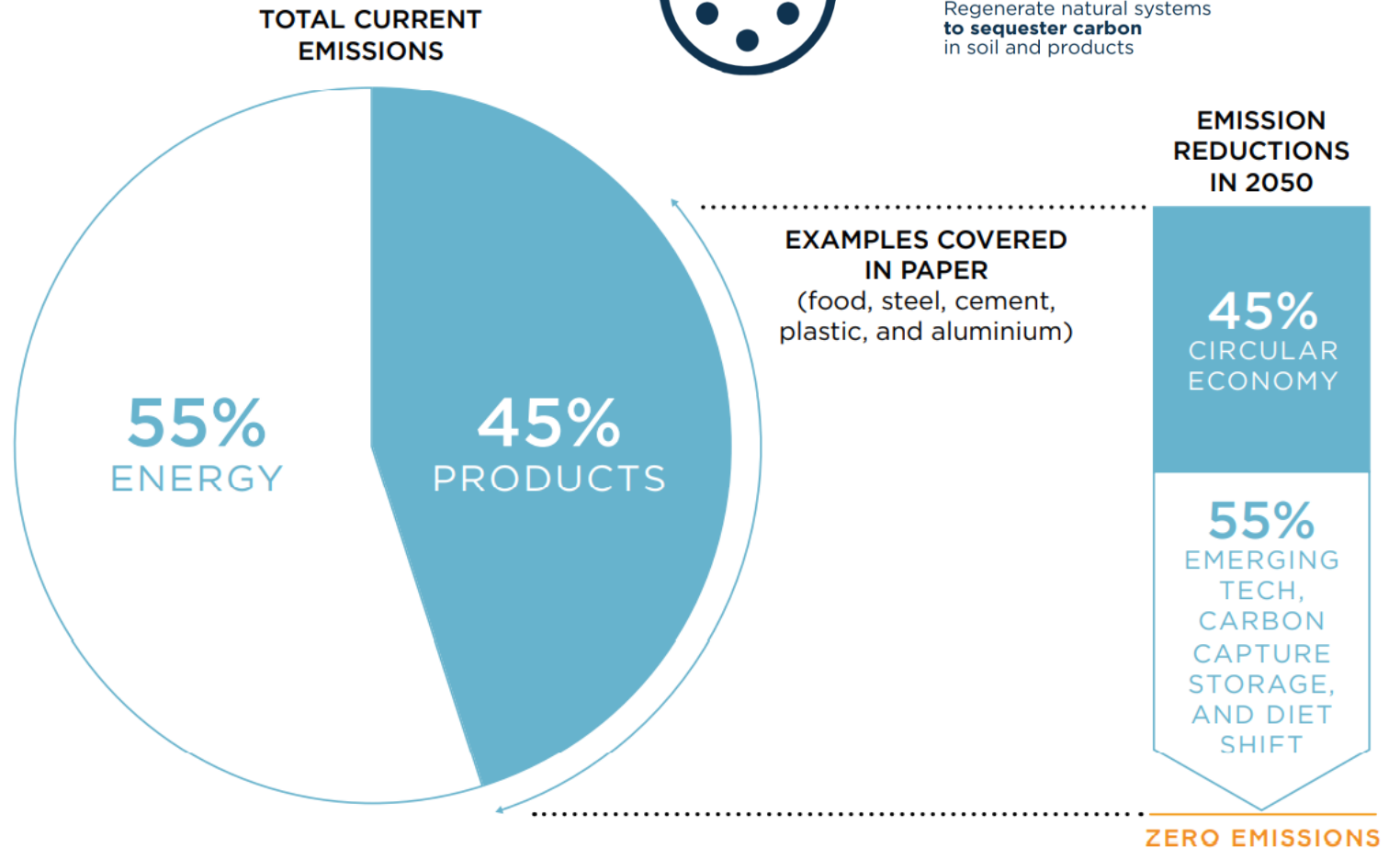


- Linear models can be seen in economic terms as a market failure (we have not yet found and applied models where we as society can reflect the hidden environmental costs in market prices)

**have caused significant impacts on the environment
such that serious changes are needed**

How a circular economy tackles climate change

- Emissions today
 - A) energy (55%)
 - B) Products (45%)
- Looking at products
 - Emissions reduction potential in 2050 enabled by circular economy



Design out waste and pollution
to **reduce GHG emissions**
across the value chain

Keep products and materials in use
to **retain the embodied energy**
in products and materials

Regenerate natural systems
to **sequester carbon**
in soil and products

Key elements of a circular economy

- Beyond a necessary energy transition

A FUNDAMENTAL
CHANGE IN THE WAY
GOODS ARE MADE AND
USED IS REQUIRED TO
MEET CLIMATE
TARGETS



Design out waste and pollution



Keep products and materials in use



Regenerate natural systems

Shocking statistics (in the EU)

- Agriculture uses 70% of global water consumption.
- 31% of food waste is lost in the value chain,
- 46% of fruit and vegetable still useful edible mass is lost,
- 60-75% of packaging is lost after the 1st use cycle,
- 8 million T of plastic floods into the ocean each year.

- 90% of the time our cars are idle,
- 60% of office space is not used during office hours.
- 90BT of natural resources extracted only 9% find their way back.
- Fast fashion is responsible for 10% of global CO₂ emissions.



[How Online Marketplace is Reducing Food Waste \(borgenproject.org\)](https://borgenproject.org/how-online-marketplace-is-reducing-food-waste/)

72% of all economic activity is related to the end user

What we buy will drive what people produce

We are inefficient as a society and need to improve this. Many inefficiencies are money lying on the floor, which if we pick up will hugely benefit the environment.

- Sustainability
- NetZero transition
- Linear vs. circular economy
- **Circular economy frameworks**
- Materials and engineered product examples
- Enablers to a CE
- Initiatives

What does a circular economy bring?

- Combat climate change
- Crisis response
- Significant improvements in human health
- Increase supply chain resilience
- Improve long term financial performance

7 principles of the circular economy

1. Design for longevity; component replacement and update through modularity
2. Reuse through refurbishment, repair or remanufacturing
3. Resource-efficient manufacturing to minimize waste generation
4. Recycling-friendly materials and design for ease of disassembly
5. Collaboration across the value chain to optimize resource utilization and waste
6. Local sourcing and production to reduce transportation emissions
7. Innovative business models such as product-as-a-service, leasing, subscription, and take-back programs to incentivize circularity, to encourage sharing and access over ownership

Circular economy business models

Close

- Material and energy recycled within the system
- Via reuse, refurbishment and recycling

Slow

- Extends the use phase
- Increased durability

Intensify

- Asset is used more via sharing

Dematerialize

- Virtual approaches to a physical asset

- ✓ efficiency and productivity,
- ✓ economic and financial viability,
- ✓ design for dis-assembly
- ✓ recovery,
- ✓ recycling,

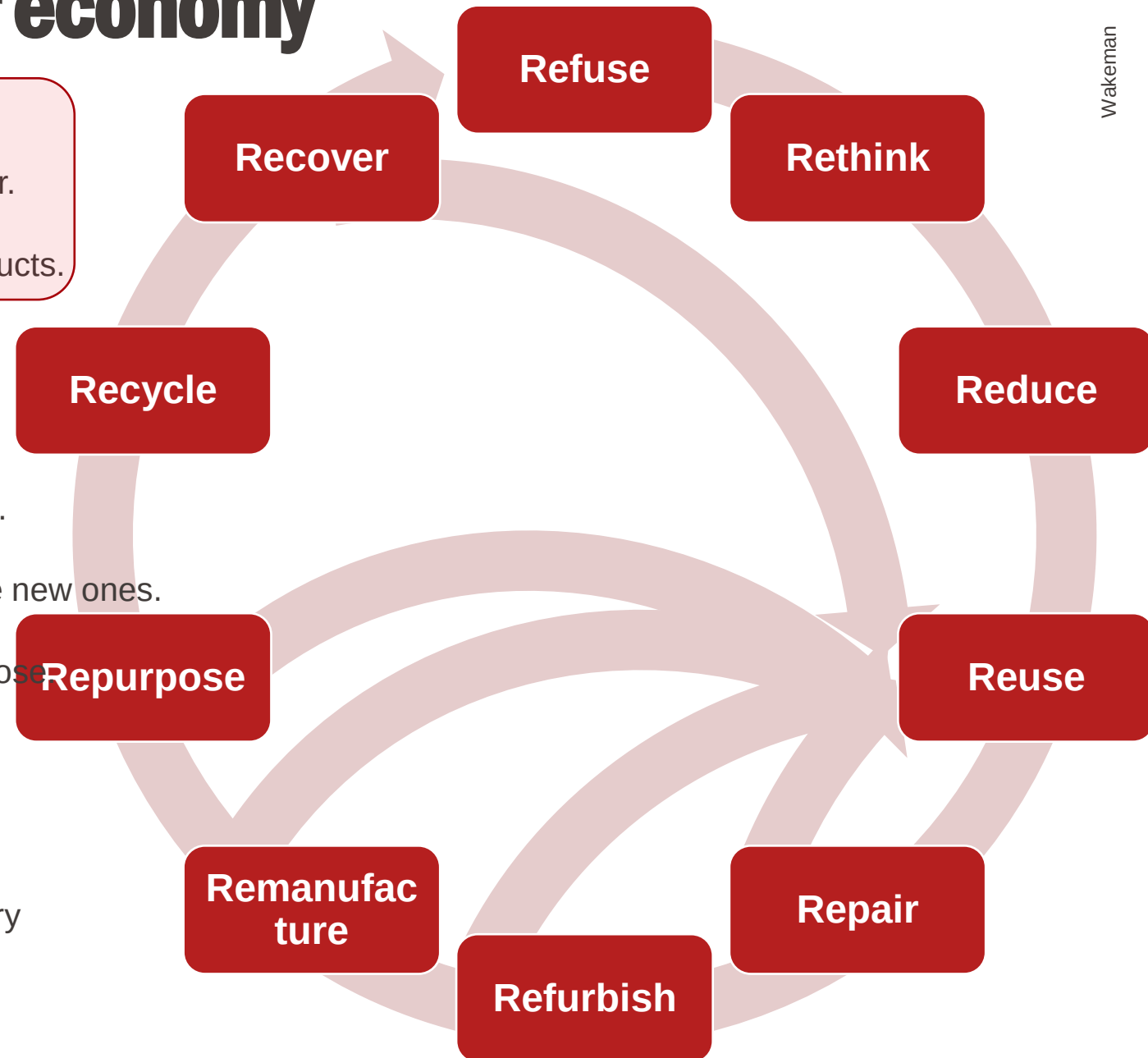
- ✓ sharing platforms,
- ✓ extending the life of assets,
- ✓ service vs. product
- ✓ if the machine is turned off, the asset is not working for you

10 R's of the circular economy

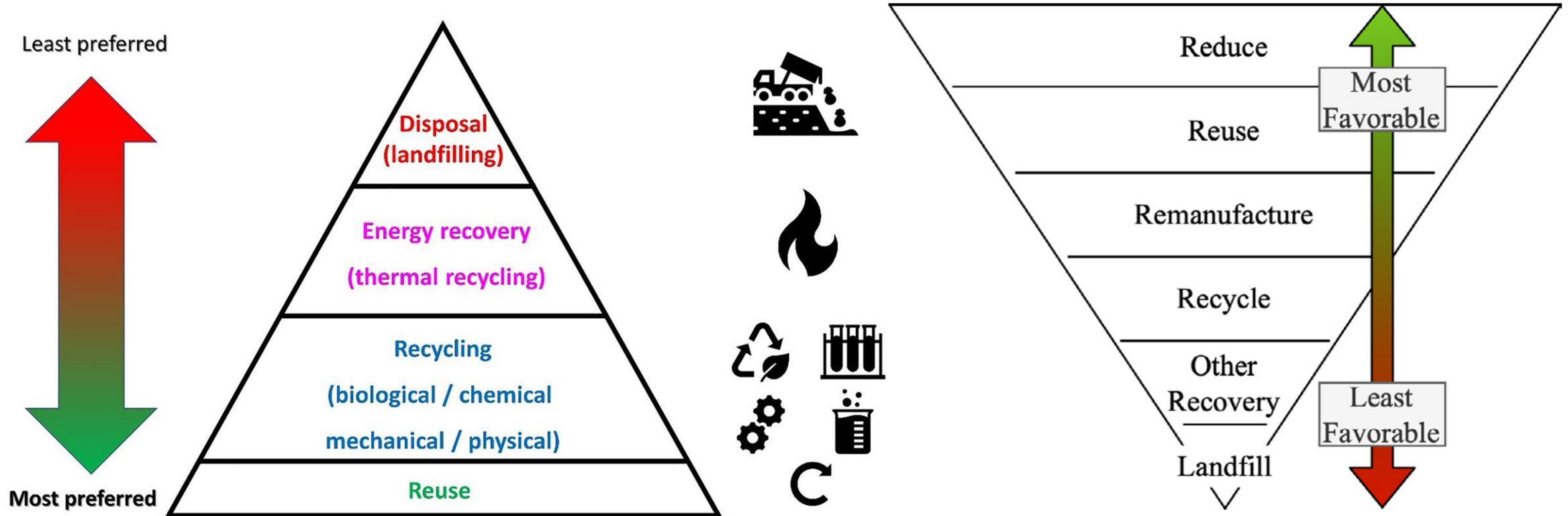
1. **Refuse:** Say no to unnecessary products and services.
2. **Rethink:** Design products and systems to be more circular.
3. **Reduce:** Use fewer resources / materials to produce products.

Sufficiency

4. **Reuse:** Use products and materials multiple times.
5. **Repair:** Fix broken products versus throwing them away.
6. **Refurbish:** Restore old products to their original condition.
7. **Remanufacture:** Disassemble / rebuild products to create new ones.
8. **Repurpose:** Use old products or materials for a new purpose.
9. **Recycle:** Convert waste materials into new products.
10. **Recover:** Extract energy or materials from waste.
11. **Relocate:** Removal of waste to a different region or country



Which one of these is incorrect?



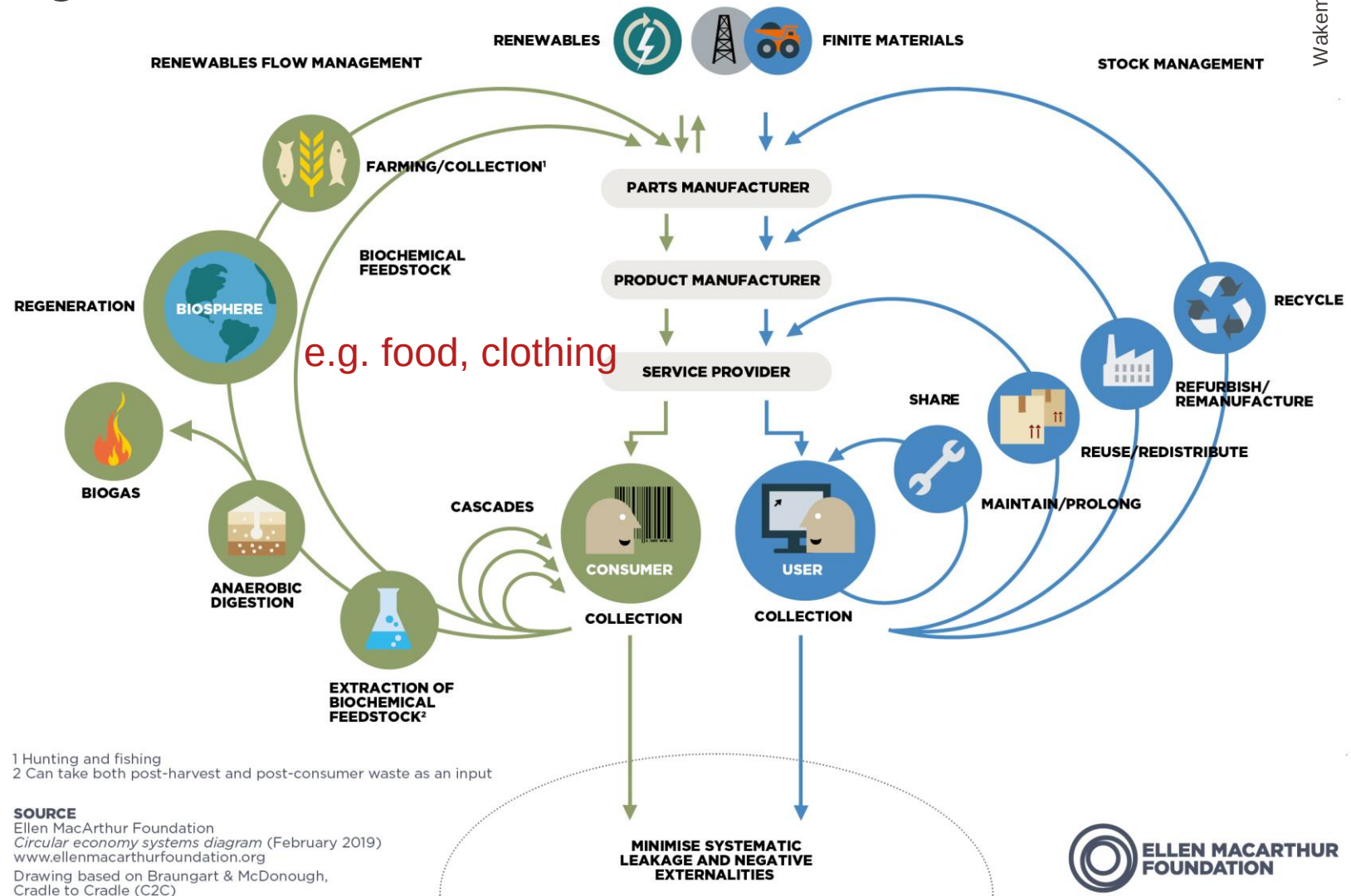
Journal of Polymer Science, Volume: 61, Issue: 17, Pages: 1937-1958, First published: 19 May 2023, DOI: (10.1002/pol.20230154)

Fig. 3. The waste hierarchy (adapted from the EU Waste Framework Directive 2008/98/EC).

Seeks to rebuild capital

- Financial
- Manufactured
- Human
- Social
- Natural

Ensures enhanced flows of goods and services.



[Circular Design Guide - Butterfly Diagram - YouTube](#)

REGENERATE



- Shift to renewable energy and materials
- Reclaim, retain, and restore health of ecosystems
- Return recovered biological resources to the biosphere



SHARE



- Share assets (e.g. cars, rooms, appliances)
- Reuse/secondhand
- Prolong life through maintenance, design for durability, upgradability, etc.



OPTIMISE



- Increase performance/efficiency of product
- Remove waste in production and supply chain
- Leverage big data, automation, remote sensing and steering



LOOP



- Remanufacture products or components
- Recycle materials
- Digest anaerobically
- Extract biochemicals from organic waste



VIRTUALISE



- Books, music, travel, online shopping, autonomous vehicles etc.



EXCHANGE



- Replace old with advanced non-renewable materials
- Apply new technologies (e.g. 3D printing)
- Choose new product/service (e.g. multimodal transport)

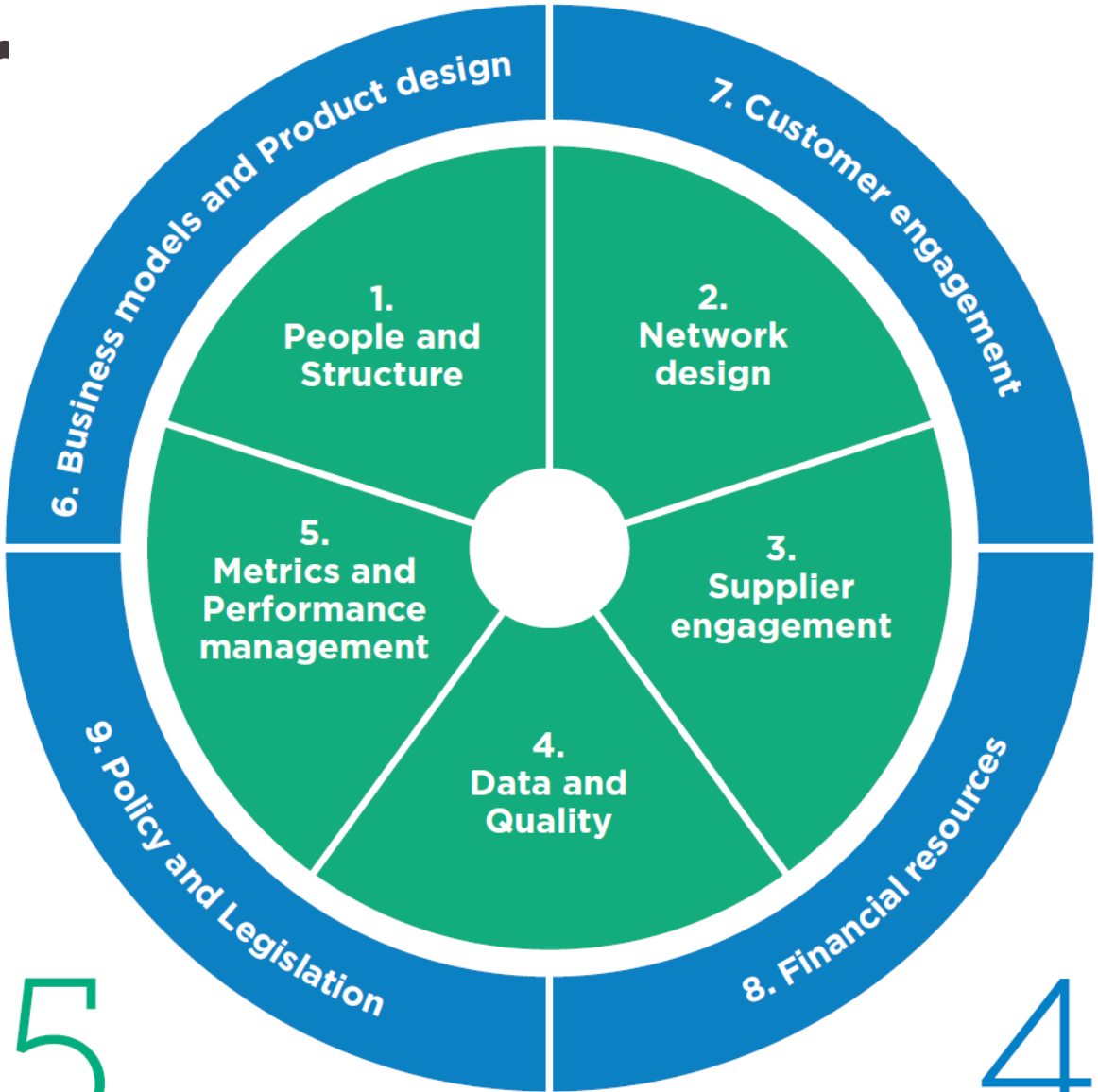


[growth_within.pdf \(mckinsey.com\)](https://www.mckinsey.com/growth_within.pdf)

Focus areas for circular supply chains



- Monetary-flow
- Mass-flow
- Emissions-flow
- Information-flow



5

areas supply chain teams can directly address

4

areas requiring collaboration with other teams

CE for supply chain resilience

- Circular economy and supply chain resilience are interconnected
- Circular supply chains decouple operations from natural resource extraction, increasing material security and reducing exposure to price volatility
- Circular economy can ensure resilience in supply chains, especially in uncertain environments



Review

Circular economy as crisis response: A primer

Kris Hartley^a, Brian Baldassarre^{b,c,e}, Julian Kirchherr^{d,e,f}

[Circular economy as crisis response: A primer - ScienceDirect](#)

VUCA

Volatile

The environment demands you react quickly to ongoing changes that are unpredictable and out of your control

Uncertain

The environment requires you to take action without certainty

Complex

The environment is dynamic, with many interdependencies

Ambiguous

The environment is unfamiliar, outside of your expertise

[Dealing with VUCA](#)

- Sustainability
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Materials and sustainability



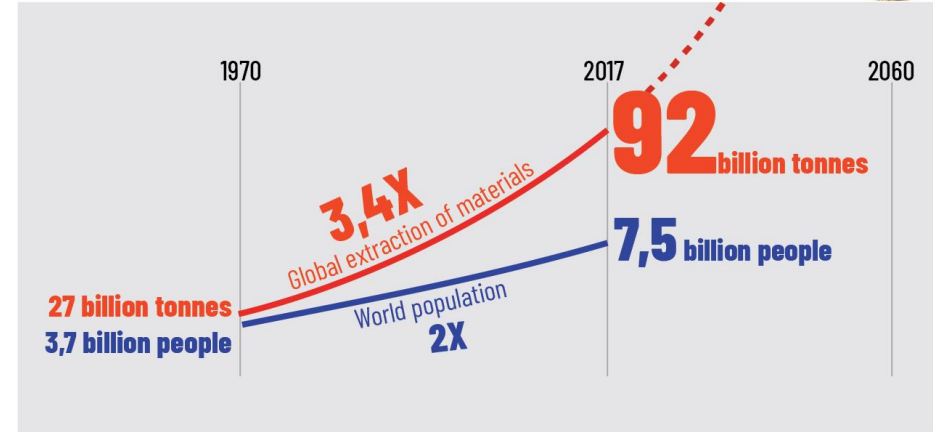
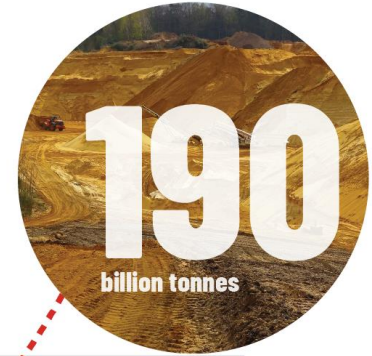
- ... yet we are 7.2% circular
- Need to transition to NetZero SSPs

- We extract over 90 billion tonnes of raw materials from our planet every year
- 6 of 9 planetary boundaries exceeded

- 45% of current emissions are in products
- Product design specifications are ~75 per cent of a product's manufacturing costs,
- **Up to 80% of a product's lifetime emissions (environmental and social impacts) are determined by decisions made during the design and material selection stage.**
- In past 6 years, we have consumed 500 BT of raws, nearly as many as cumulative total since 1900

WHY TAKE ACTION

it is impossible to continue extracting as we have been doing



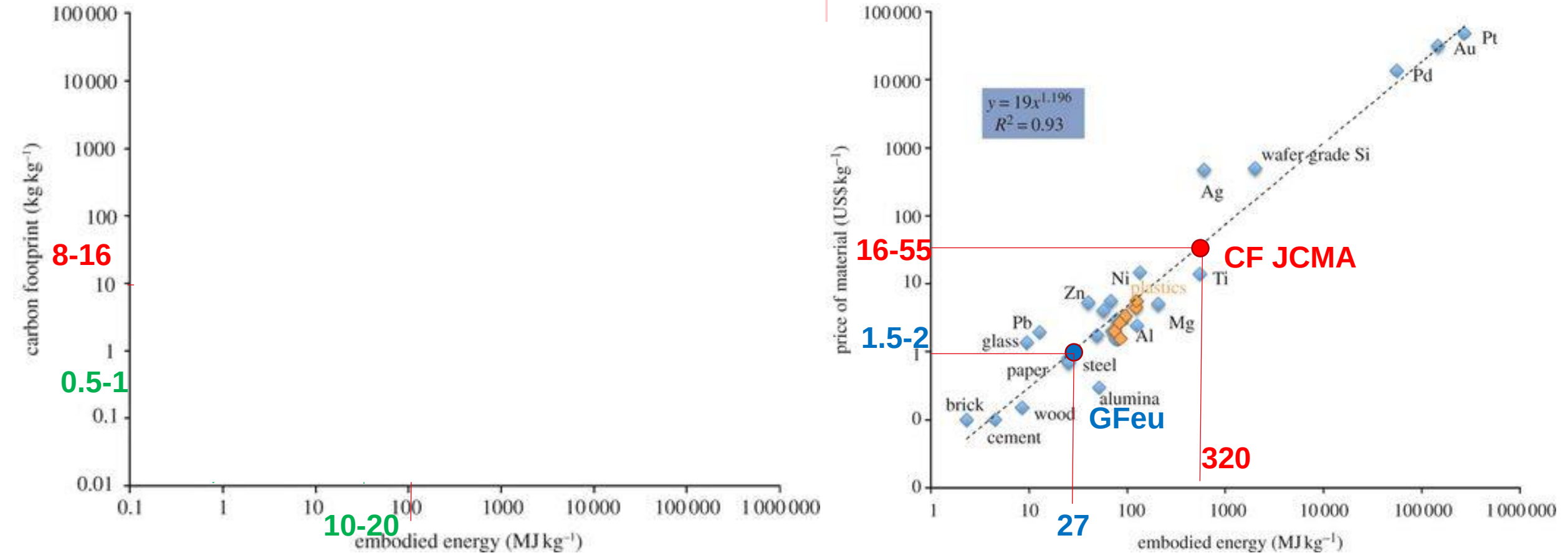
If we continue business as usual, we will **double** the extraction of materials¹ in 2060, far beyond the planetary boundaries².

Source: IRP (2019): Global Resources Outlook 2019: Natural Resources for the Future We Want. A Report of the International Resource Panel. United Nations Environment Programme. Nairobi, Kenya
 1: "Materials" include biomass, fossil fuels, metals and non-metallic minerals, being a subset of natural resources which encompasses all material plus water and land.
 2: For more information: <https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html>

- Systemic change is needed

Re-defining Value – The Manufacturing Revolution | Resource Panel

CO₂e vs. MJ/kg vs. \$/kg

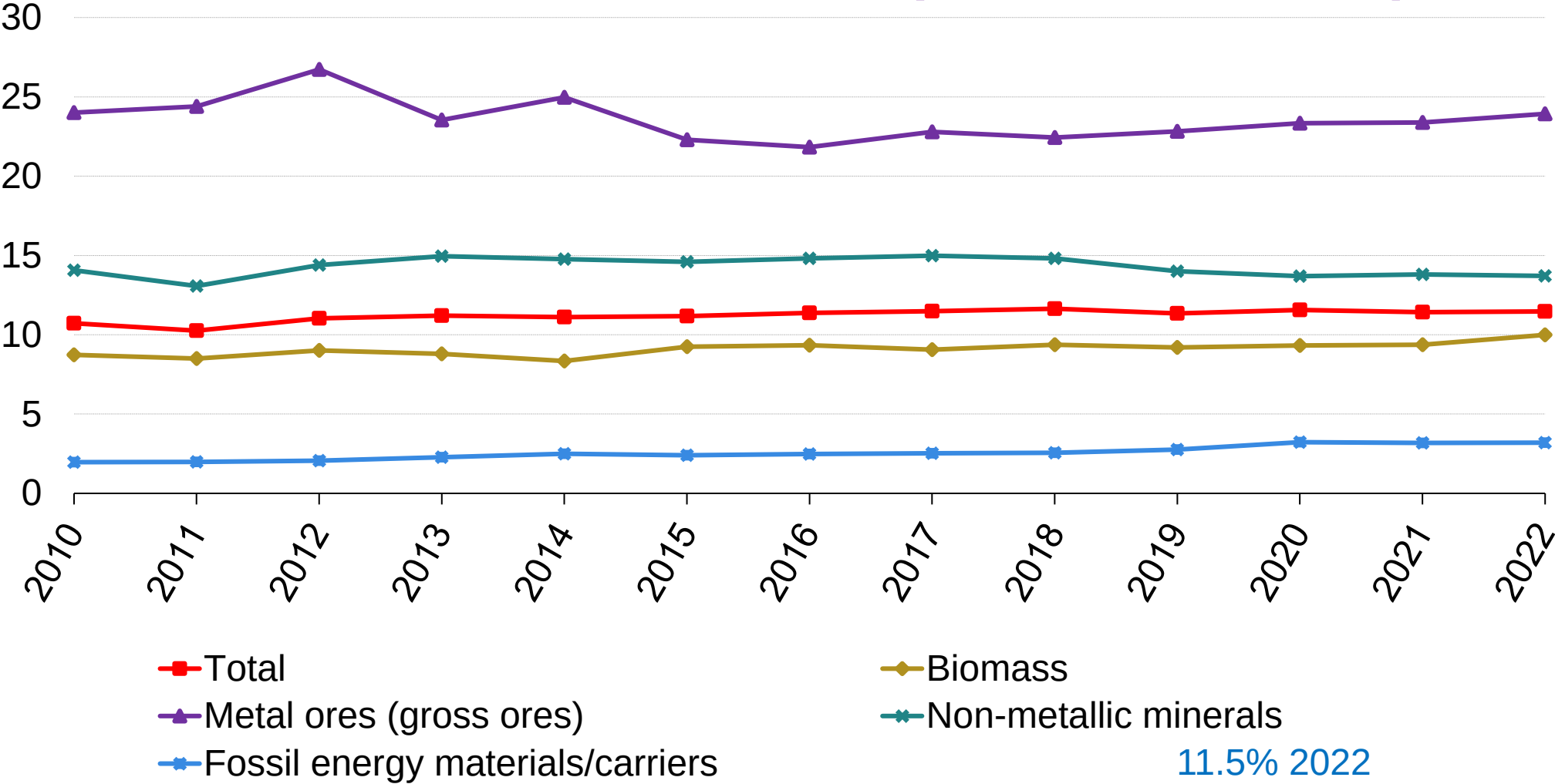


Energy intensity of derivatives and conversion drives environmental foot print and economics

-
- Material flows in the EU in 2018 (Giga Tonnes)**
- | Flow Category | Value (Giga Tonnes) |
|-----------------------------|---------------------|
| Imports | 1.60 |
| Natural resources extracted | 5.54 |
| Direct material inputs | 7.14 |
| Processed material | 8.16 |
| Material used | 4.98 |
| Material accumulation | 3.21 |
| Backfilling | 0.25 |
| Recycling | 0.77 |
| Exports | 0.7 |
| Dissipative flows | 0.25 |
| Total emissions | 2.36 |
| Emissions to air | 2.35 |
| Incineration | 0.11 |
| Waste landfilled | 0.63 |
| Landfill | 0.6 |
- Summary of Key Flows:**
- Inputs:** Natural resources extracted (5.5) + Imports (1.6) = 7.1 Gt.
 - Processing:** 7.1 Gt of direct material inputs leads to 8.1 Gt of processed material.
 - Use and Disposal:** 5 Gt of material is used, leading to 3.21 Gt of accumulation, 0.25 Gt of backfilling, and 0.77 Gt of recycling.
 - Emissions:** 2.4 Gt of emissions to air and 0.6 Gt of landfill.
- Source:** Eurostat

Circularity rate by main type of material, EU, 2010-2022 (%)

Global rate is 7.2% in 2023 (was 9.1% in 2018)



Source: Eurostat (online data code: env_ac_curm)

11.5% 2022
Circularity rate, EU (Eurostat),
2004-2022 (%)

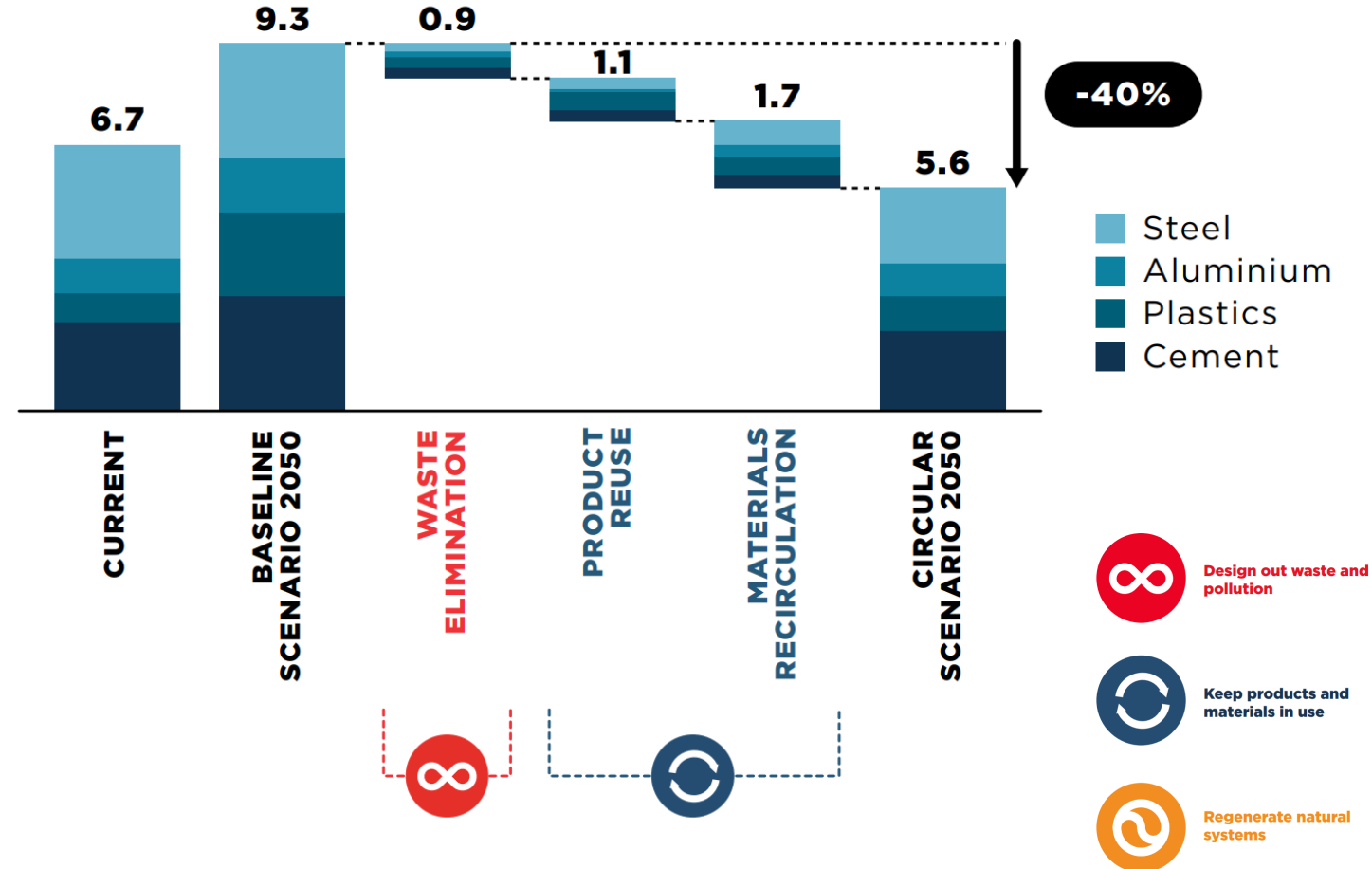
[CGR 2024 \(circularity-gap.world\)](https://circularity-gap.world)

Hard to abate materials

- Industry responsible for ~21% of global CO₂ emissions
- 60% of this is production of **cement, steel, plastics & aluminum**
- Use of these materials in passenger cars and buildings is 73% of the emissions from producing these four materials

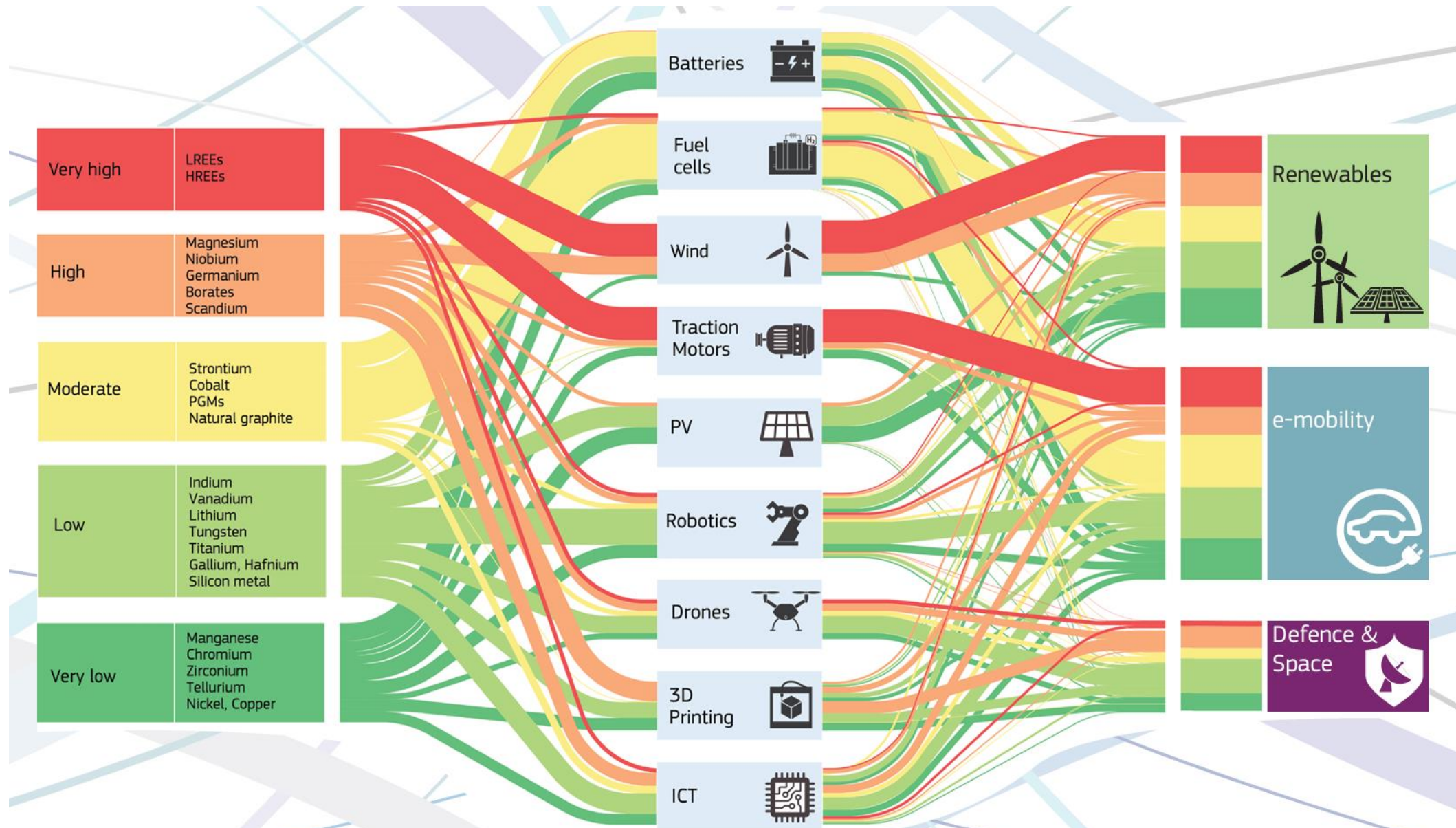
FIGURE 4: A CIRCULAR ECONOMY COULD REDUCE ANNUAL GLOBAL CO₂ EMISSIONS FROM KEY INDUSTRY MATERIALS BY 40% OR 3.7 BILLION TONNES IN 2050

Global CO₂ emissions from four key materials production
Billion tonnes of CO₂ per year

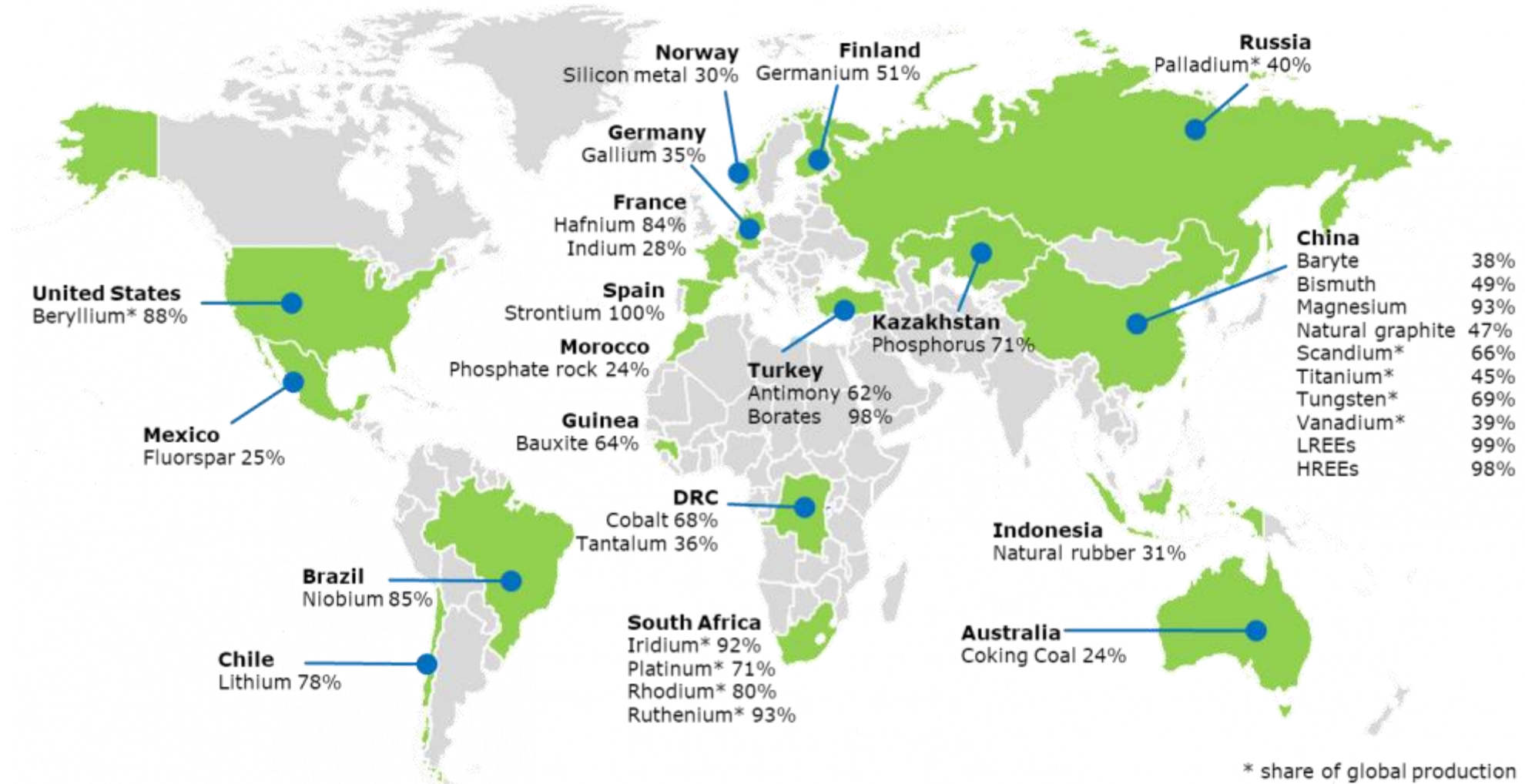


[Completing The Picture - How The Circular Economy Tackles Climate Change | Shared by Comms \(thirdlight.com\)](#)

Critical materials



Supply of rare earth to EU

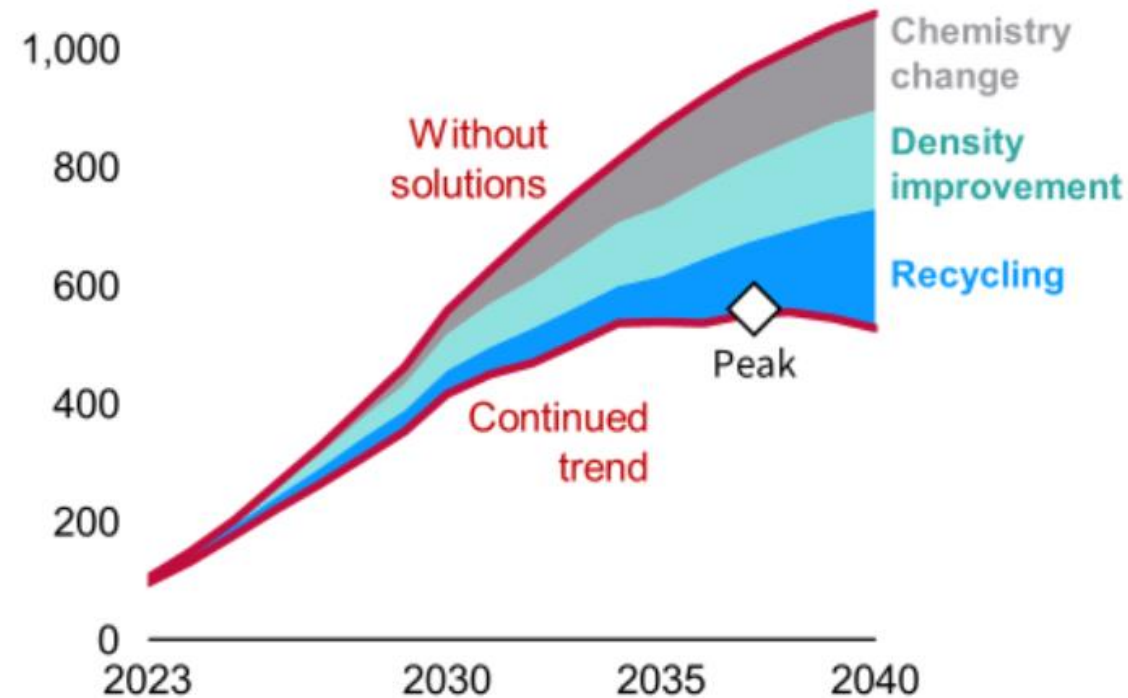


[Critical Raw Materials Act to Secure Supply of Rare Earths to EU | Semiconductor Materials and Equipment \(abachy.com\)](#)

Circular approaches critical to raw materials extraction and EVs

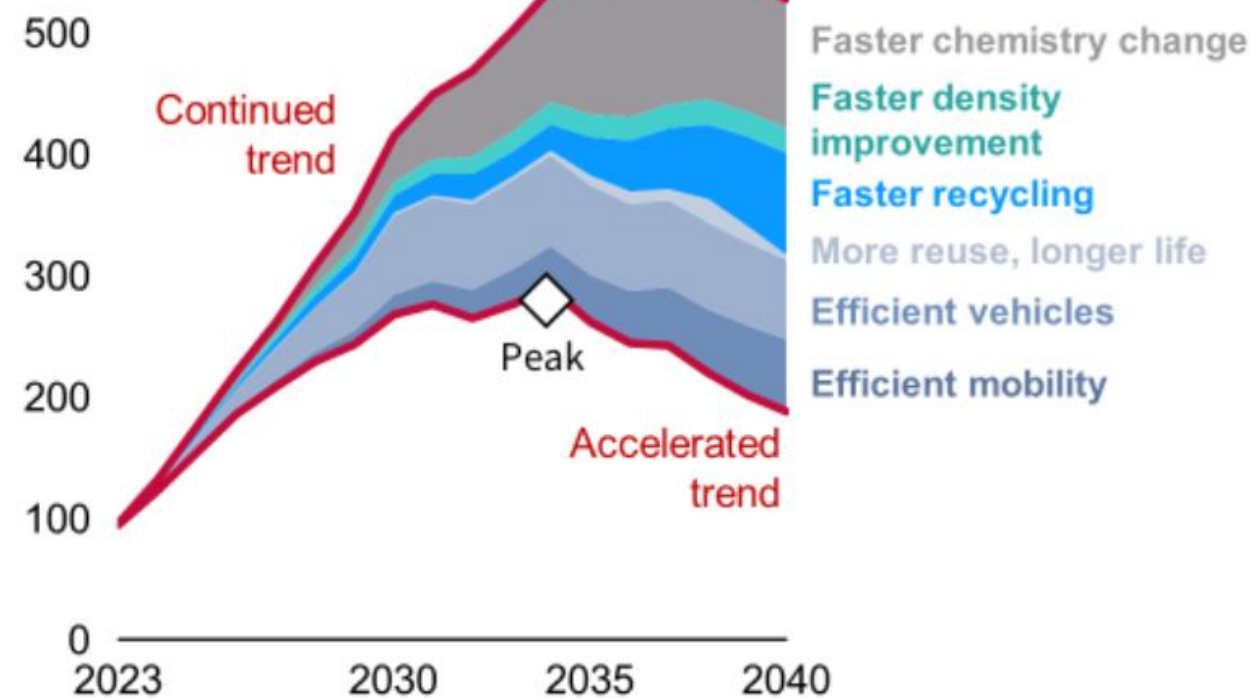
Net lithium demand, fast uptake

1,200 kilotons per year



Net lithium demand, fast uptake

600 kilotons per year



EV ESG (Environmental Social Governance) ratings?

- EVs today do not give lower ESG ratings vs. conventional OEMs
- Need to move from linear to circular model
- Beyond the use phase

You	1	2	3
Volvo Car AB	Tesla, Inc.	Geely Automobile Holdings Ltd.	Bayerische Motoren Werke AG
ESG RISK RATING 19.0 Low 	ESG RISK RATING 24.7 Medium 	ESG RISK RATING 15.9 Low 	ESG RISK RATING 22.9 Medium
EXPOSURE Medium 	EXPOSURE Medium 	EXPOSURE Medium 	EXPOSURE Medium
MANAGEMENT Strong 	MANAGEMENT Average 	MANAGEMENT Strong 	MANAGEMENT Strong
TOP MATERIAL ESG ISSUES ? Product Governance Corporate Governance Human Capital Business Ethics	TOP MATERIAL ESG ISSUES ? Product Governance Human Capital Corporate Governance Business Ethics	TOP MATERIAL ESG ISSUES ? Carbon - Products and Services Corporate Governance Human Capital Human Rights - Supply Chain	TOP MATERIAL ESG ISSUES ? Product Governance Business Ethics Carbon - Products and Services Human Capital
CONTROVERSY RATING Moderate	CONTROVERSY RATING Significant	CONTROVERSY RATING No Controversy	CONTROVERSY RATING Significant

Re-manufacturing example: Renault REfactory

Remanufacturing operation

- Reverse logistics ecosystem of partner companies
- Collects the old parts, dismantles and checks conformity,
- Reassembles, sells on as genuine and guaranteed parts
- Parts 40% less expensive vs. new, undergo same quality tests

volume of remanufactured engine parts is significant

- Gearboxes
- Engines
- Turbos
- Injectors)

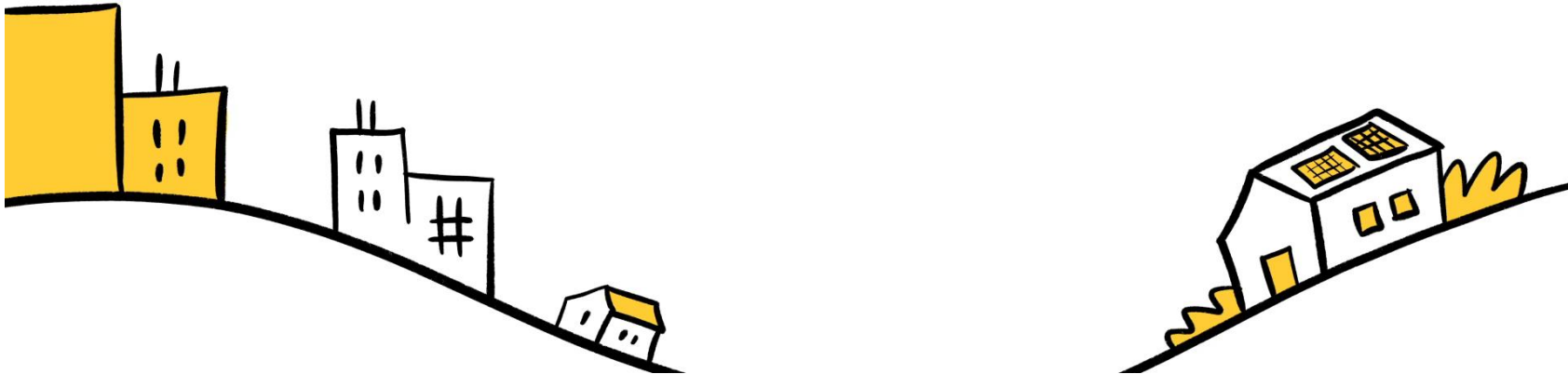
Since 2012

- Gearboxes > 112, 000, 60% of components renovated.
- Engines > 73, 000, 60 to 70% of components renovated.
- Turbos > 50, 000, 40% of components renovated.
- Injectors > 94, 000 (since 2010)

Groupe Renault creates the first european factory dedicated to the circular economy of mobility in Flins - Newsroom Renault Group

- [The circular economy in action \(ellenmacarthurfoundation.org\)](https://ellenmacarthurfoundation.org)

GROUPE
RENAULT



2min40s

- Sustainability
- NetZero transition
- Linear vs. circular economy
- Circular economy frameworks
- Materials and engineered product examples
- Enablers to a CE
- Initiatives

Circular Supply Chains Are More Sustainable. Why Are They So Rare?

by Khaled Soufani and Christoph Loch

**Harvard
Business
Review**

June 15, 2021

slido



What is inhibiting wider adoption of a circular economy?

① Start presenting to display the poll results on this slide.

Barriers to Circular supply chains?

- Successful examples tend to be local with products and services made of relatively limited number of components
- Human supply chains:
 - 1) performance via parts specialization AND
 - 2) economic efficiency via economies of scale

Consumers: give up performance for environmental sustainability

Business: give up some of the economies of scale and make less sophisticated products



More standardization designed in (for local recycling vs. aggregation)

Society needs to embrace this change

1. Government and policy
 2. Finance and investment
 3. Technology
 4. Reporting
 5. NetPositive
- Innovation

 - To address productivity

- Education
- Be consistent with the goal
- Build infrastructure



Innovation needed:

- **To address problem of over-consumption and over-production (places stress on natural resources)**
- **In Government policies**
- **In businesses, (how products are delivered, business models (circular vs. linear), the supply chain, recovery & recycling, durable products, service models, ...**
- **Consumers (how they select and dispose of products)**
- **Technology and up-scaling**

Enablers: Role of Government Policy

Give vision

- Not fix market failure

Guide

- Towards circular economy
- Lubricate system with funding

Incentives

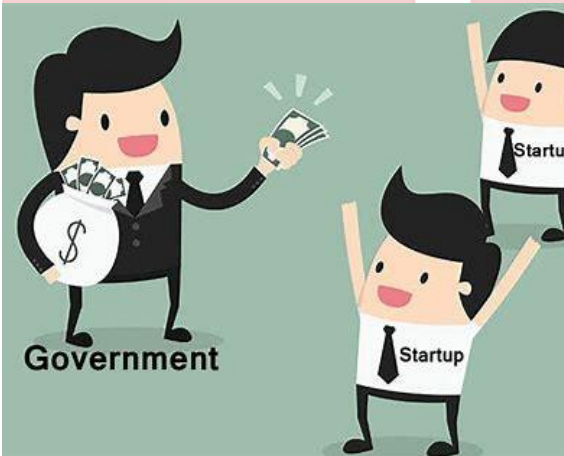
- Financial support, creation of opportunities, control depreciation
- Needs to be direct, traceable, and measurable

Collaborations

- Public and private partnerships
- Public sector assumes risk
- Private sector provides the technology focused on circularity.

Policy

- Achieve growth
- Create jobs
- Stabilize economies
- Utilize a countries own resources (reducing imports)



This has started yet the funding levels do not represent the challenge ahead.



Enablers: finance (Investors are reacting)

Investors

- Moving to favor sustainable enterprises
- Seen as more attractive long term investment opportunities

Companies

- Naturally remain profitable and attractive

Investing

- Sustainability is an attractive and rapidly growing opportunity
- Growth of 27%

Growth

- Double digit growth
- Major mega trend
- Trillion-dollar business opportunity
- Growing demand for such products and services

Objectives

- Companies establish
 - social and environmental objectives
- Monitor and review them



There is already around
T\$1.16 invested in impact
investments



[J.P. Morgan Investment Outlook 2021](#) | [J.P. Morgan Asset Management \(jpmorgan.com\)](#)

[GIINsight: Sizing the Impact Investing Market 2022 - The GIIN](#)

Enablers: evolving business models

All businesses need sustainable business models

Incorporate socially and environmentally sustainable practices

Transition: Can keep running linear models while at the same time transferring to circular models

Redesign supply chains for agility

As a lattice rather than rigid constructs today:
i) onshore, ii) near shore, iii) off shore

Bring sustainability into our **value propositions**

Start-ups to transformation, diversification, acquisitions

Not a “race to the bottom of the linear economy”

risk of staying as we are seen with covid-19 & vulnerable, fragmented, and fragile supply chains.

Covid-19 has moved this thinking 5 years into the future.

Ford will split company in two as it ramps up electric car production

By Ariel Zilber

March 2, 2022 | 12:01pm | Updated



Ford will split company in two as it ramps up EV production (nypost.com)



Random Walk: The Race to the Bottom to Accelerate?WE (sjrefugee.blogspot.com)

Enablers (Sustainable finance)

- To increase focus on sustainability:
the earnings retention ratio will ultimately need to be altered such that less is paid as dividend and more is reinvested (Stakeholders vs. shareholders).
- Sustainable finance covers capital budgeting including the

Structure

- where capital is sourced from
- equity from shareholders and owners
- debt from banks and bond holders

Working capital

- cash in [sales, inventory, pre-paid expenses]
- cash out flows [pay suppliers, salaries, interest, tax]

Sustainable practices include:
payment terms, supplier conditions, and salaries.

Enablers (Sustainable finance)

- Sustainability approaches can increase EBITDA: (earnings before depreciation and amortization)

Reducing COGs (cost of goods sold)

- efficiency gains
- waste management

Reducing OPEX (operating expenses)

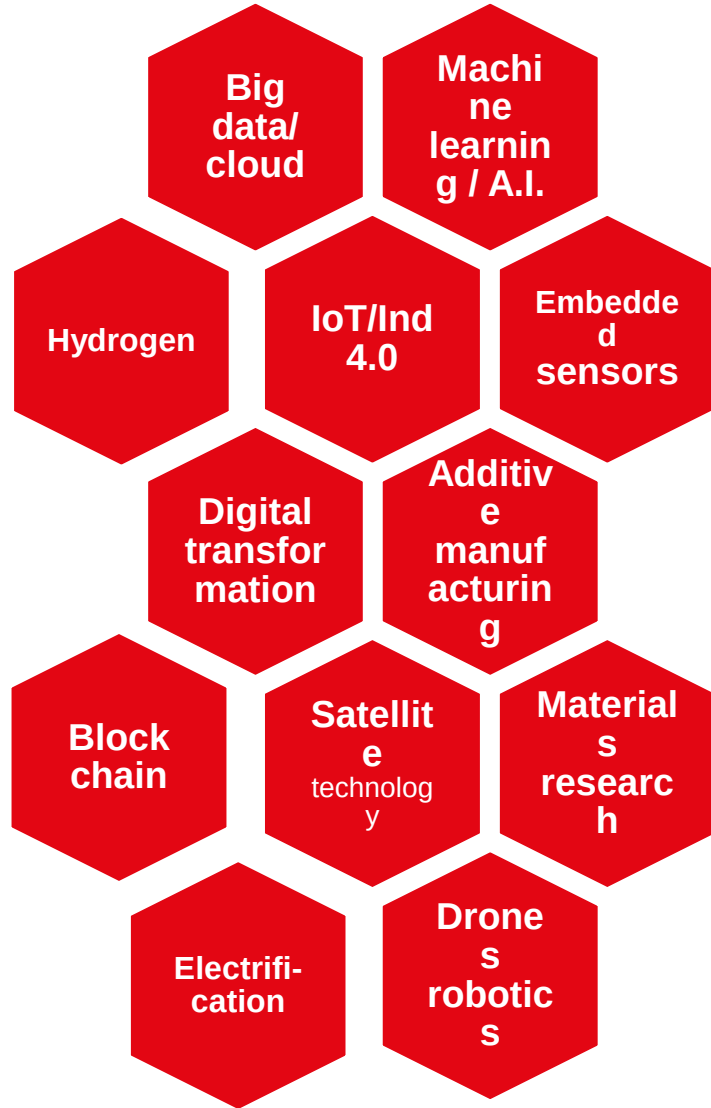
- sharing
- leasing
- service approaches

Increasing revenue

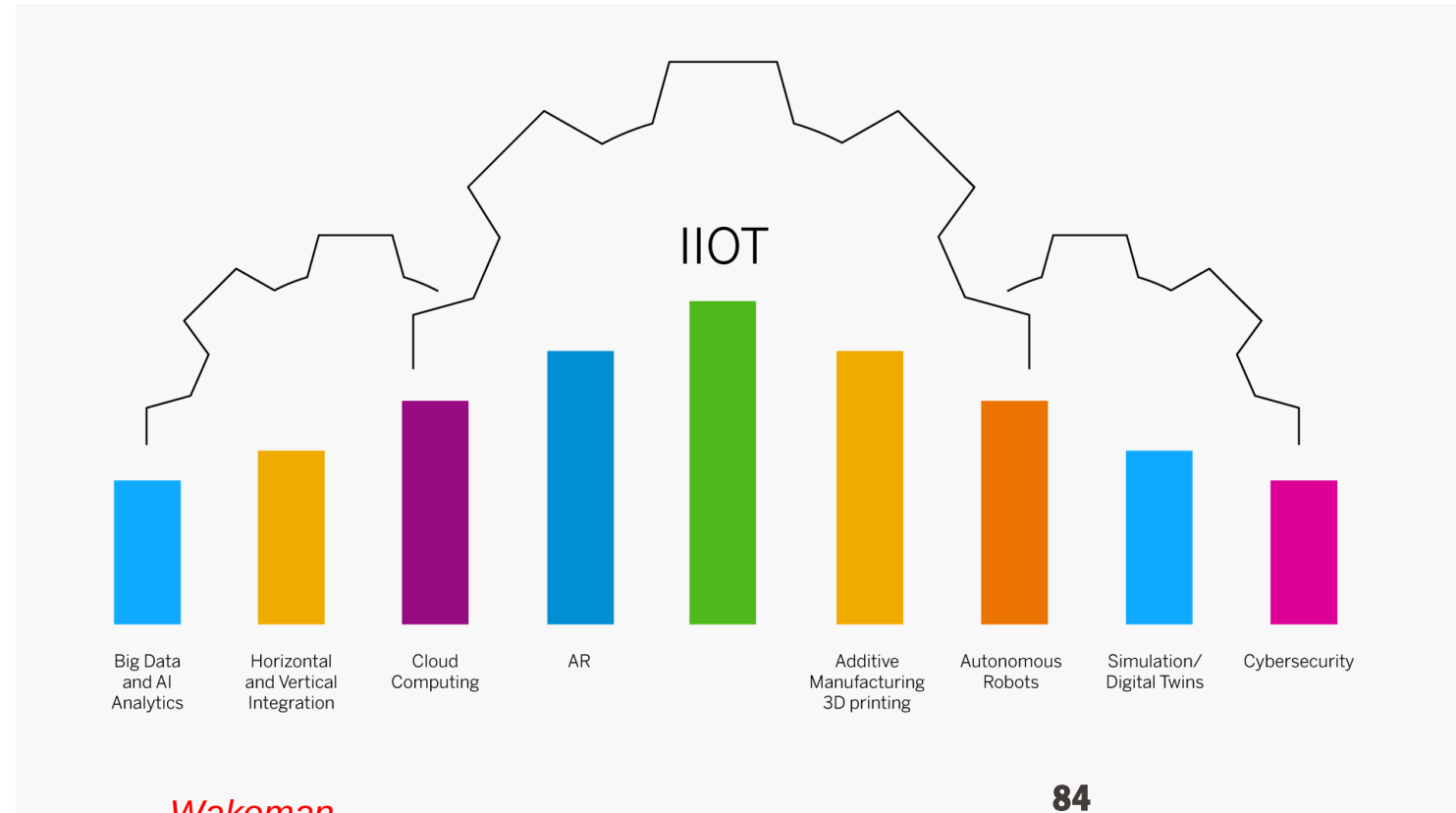
- more desirable products
- customers sensitive to sustainability issues will demand

- Can increase gross margin
- Sustainable feedstocks can be more costly

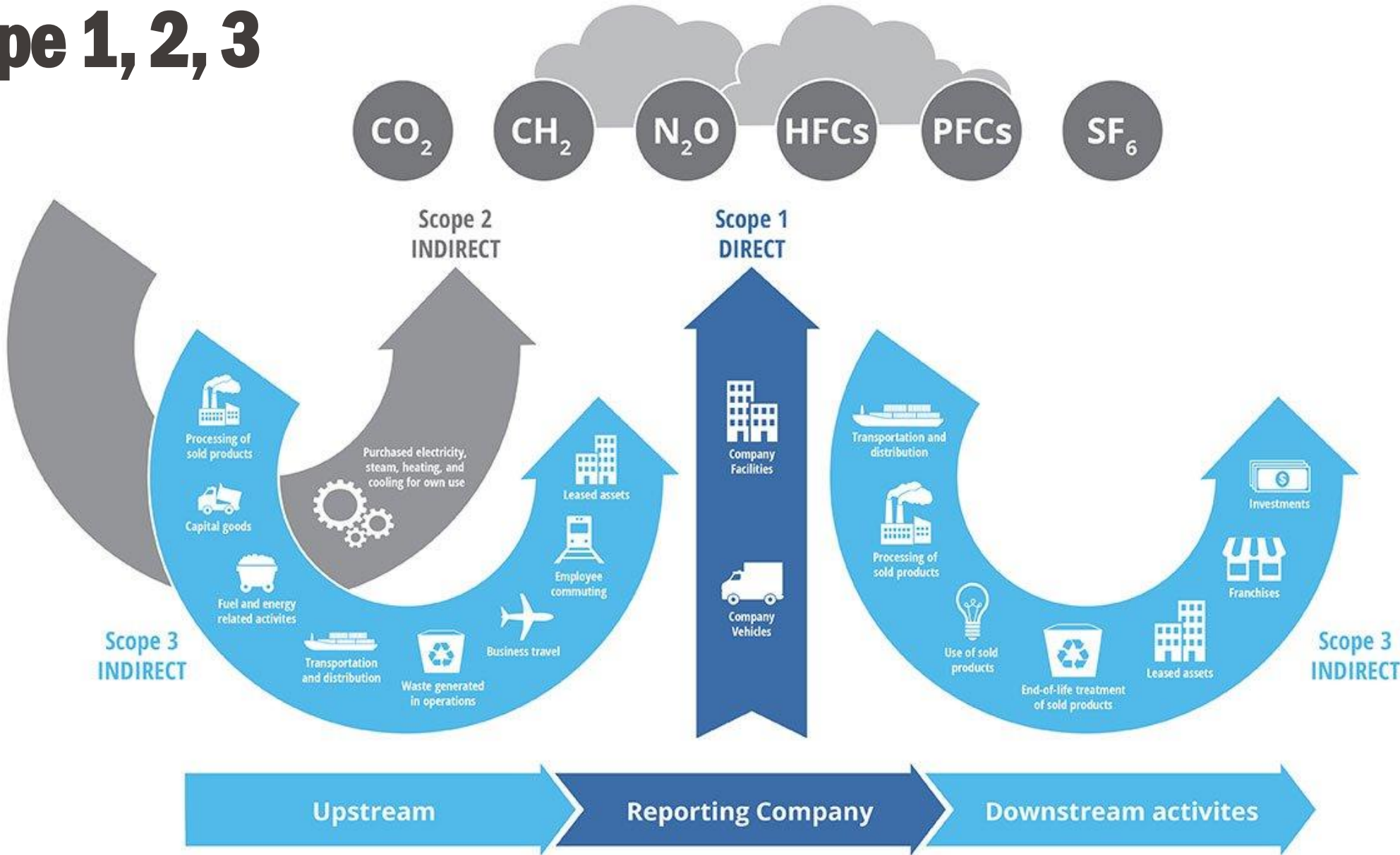
Technological enablers to circularity / NetZero



The advanced materials industry has a huge opportunity to create a circular economy, create clean energy, to mitigate climate change ...



Scope 1, 2, 3



Harvard
Business
Review

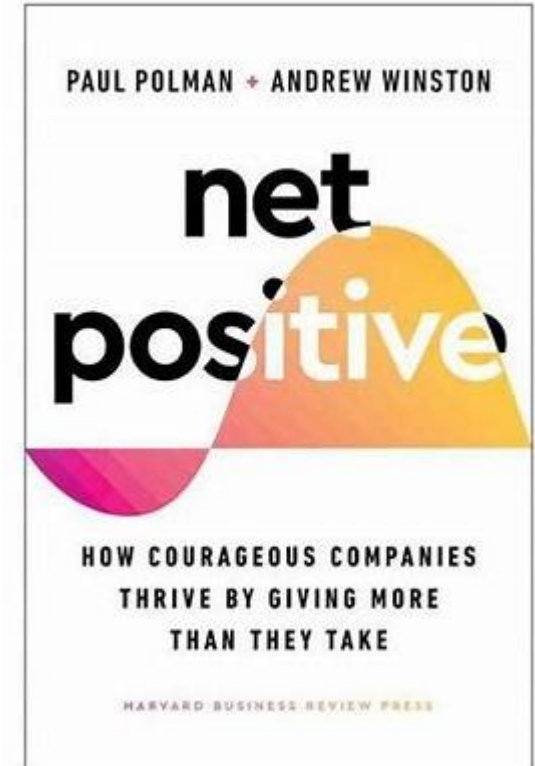
Strategy | The Net Positive Manifesto

The Net Positive Manifesto

Is the world better off because your company is in it? by Paul Polman
and Andrew Winston

From the Magazine (September–October 2021)

- Both practically and morally, corporate leaders can no longer sit on the sidelines of major societal shifts or treat human and planetary issues as “someone else’s problem.”
- For their own good, they must play an active role in addressing our biggest shared challenges.
- The economy won’t thrive unless people and the planet are thriving.



A “NetPositive” company is one that grows by helping the world flourish. They:

1. Operate 1st in service of multiple stakeholders—
which *then* benefits investors (as opposed to putting shareholders above all others)
2. Take full ownership of all company impacts (scope 1, 2, 3)
3. Embrace deep partnerships, even with critics;
4. Tackle systemic challenges by rethinking advocacy and the relationship with governments.

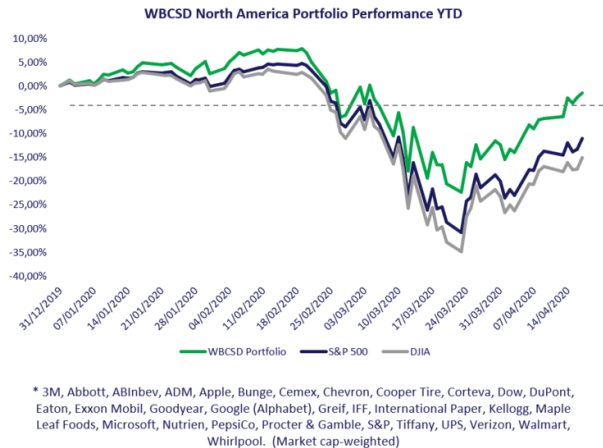
No company has yet reached the ambitious goal of becoming net positive. But a growing number have begun the journey—unlocking greater value for their businesses while helping solve larger problems for the benefit of all.

ESG outperformance amid COVID-19 crisis

31 North American member stocks weathered downturn better than the market

Consistently outperforming: WBCSD portfolio* beat the market by about 10% year to date

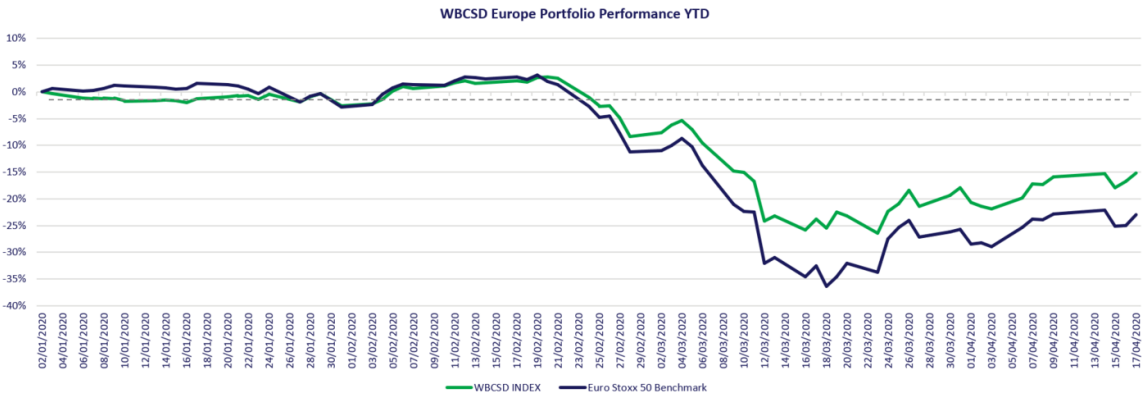
Rapid recovery from the crisis lows: almost returned to business-as-usual price level



ESG outperformance amid COVID-19 crisis

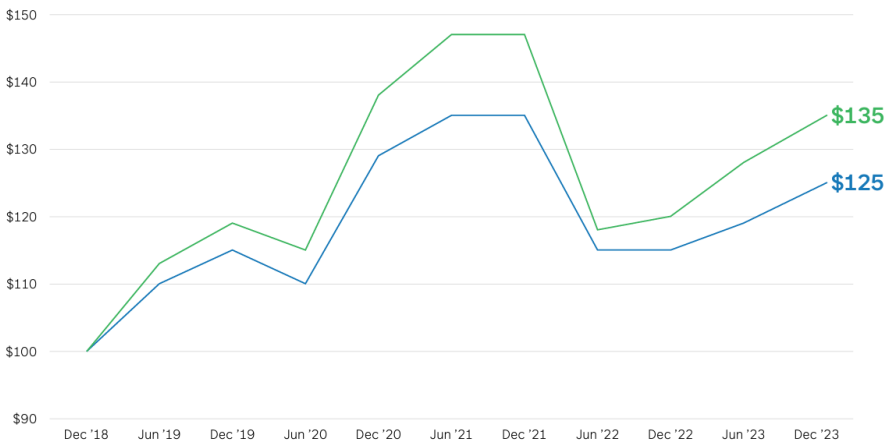
67 stocks of European members are more resilient in the view of investors

Significant better performance in the bearish market: reflecting investor confidence in European members



Five Year Performance of Sustainable and Traditional Funds

Five Year Performance
(December 2018 = \$100)



The chart shows how a \$100 investment in December 2018 would have performed if the sustainable/traditional fund achieved the median return in each period.

- Focus on sustainability helped relative performance during Covid-19 market turbulence.

2020: a different kind of “super year” - World Business Council for Sustainable Development (WBCSD)

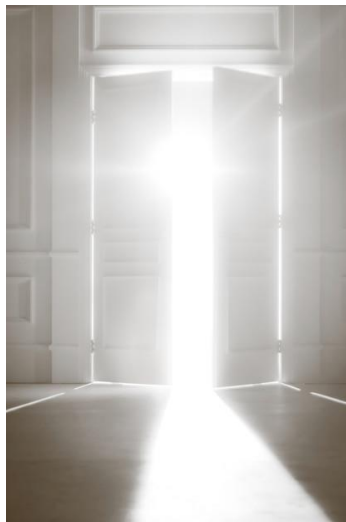
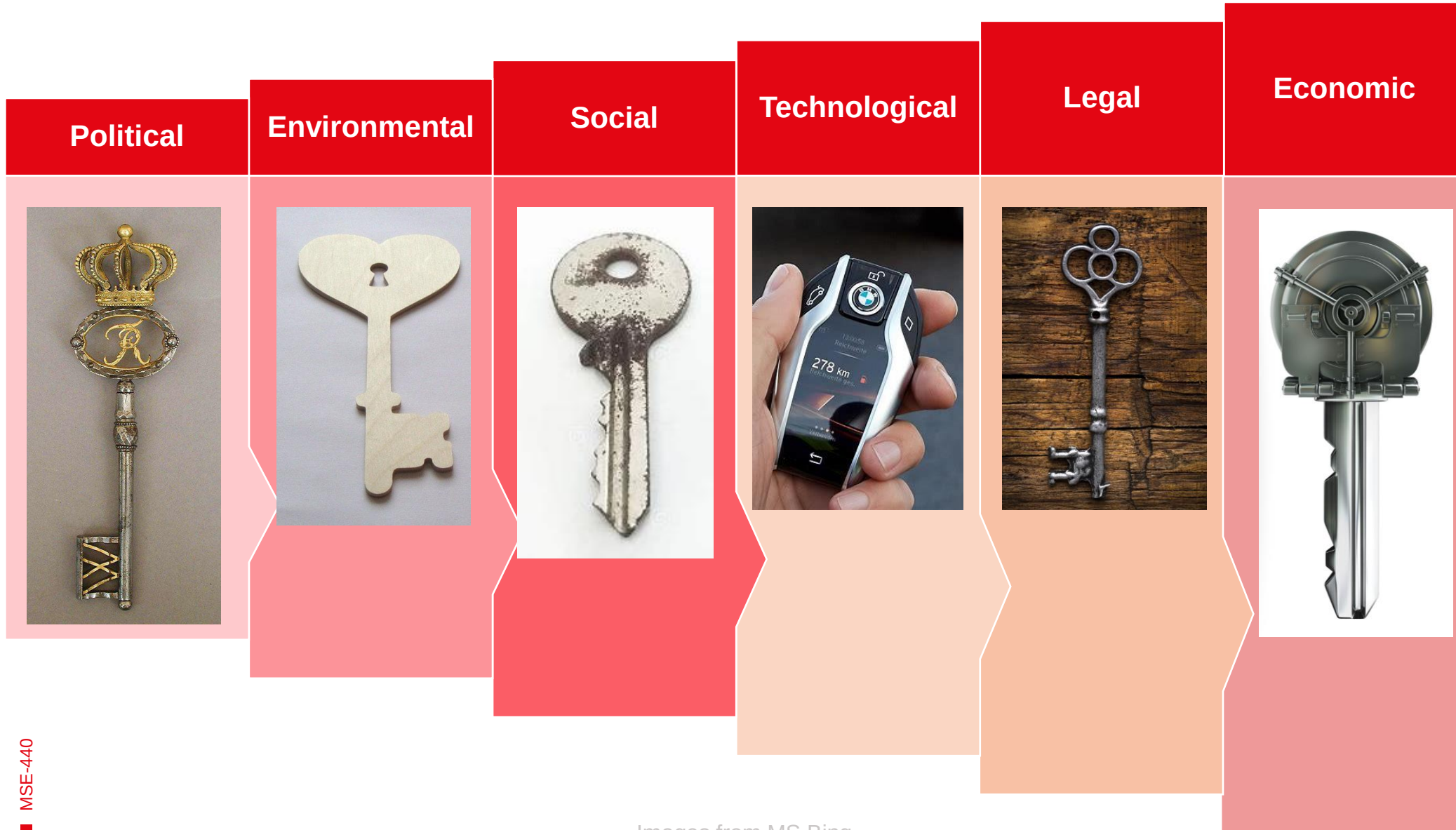
- Sustainable funds outperformed over last 5 years (MorganStanely)

MSInstituteforSustainableInvesting-SustainableRealityFY2023-Final.pdf (morganstanley.com)



- **Innovation is needed: Government, Policy, Finance, Universities**
- **Technology: works best in a systems approach**

PESTLE level thinking for systemic change



Business models

NetPositive /
regenerative

Circular financial
flows

Product
differentiation

Leasing

Servitization

Sharing (access
over ownership)

Take back
programs

Customer
communication /
marketing

Supply chain

Local sourcing and
production

Collaboration co-
invest across value
chain

Reduce
transportation
emissions

Sell waste as
product

Reverse logistics

Engage wider
stakeholders

Reduce upstream
scope 3 emissions

Production

Minimize production
waste

Resource efficient
manufacturing
assets

Avoid low utilization
physical assets via
lease

Reduce scope 1
and scope 2 indirect
emissions

Renewable energy

Plant / partnerships
to enable
refurbishment /
remanufacturing

Design

Durability/
longevity

For dis-assembly

Optimized (reduce
mass)

For repair

Supply chain
collaboration

For lowest scope
3 downstream /
use phase / EL
emissions

Materials

Lowest embodied
energy materials

Use lower environmental
impact materials

Use recycled / 2ndary /
waste materials

Use less types of
material

Use easier to recycle
materials

Summary: Eliminate. Circulate. Regenerate.

to reduce emissions and meet the targets set out in the Paris Agreement

Half of the story

- The transition to renewable energy is vital in order to tackle climate change

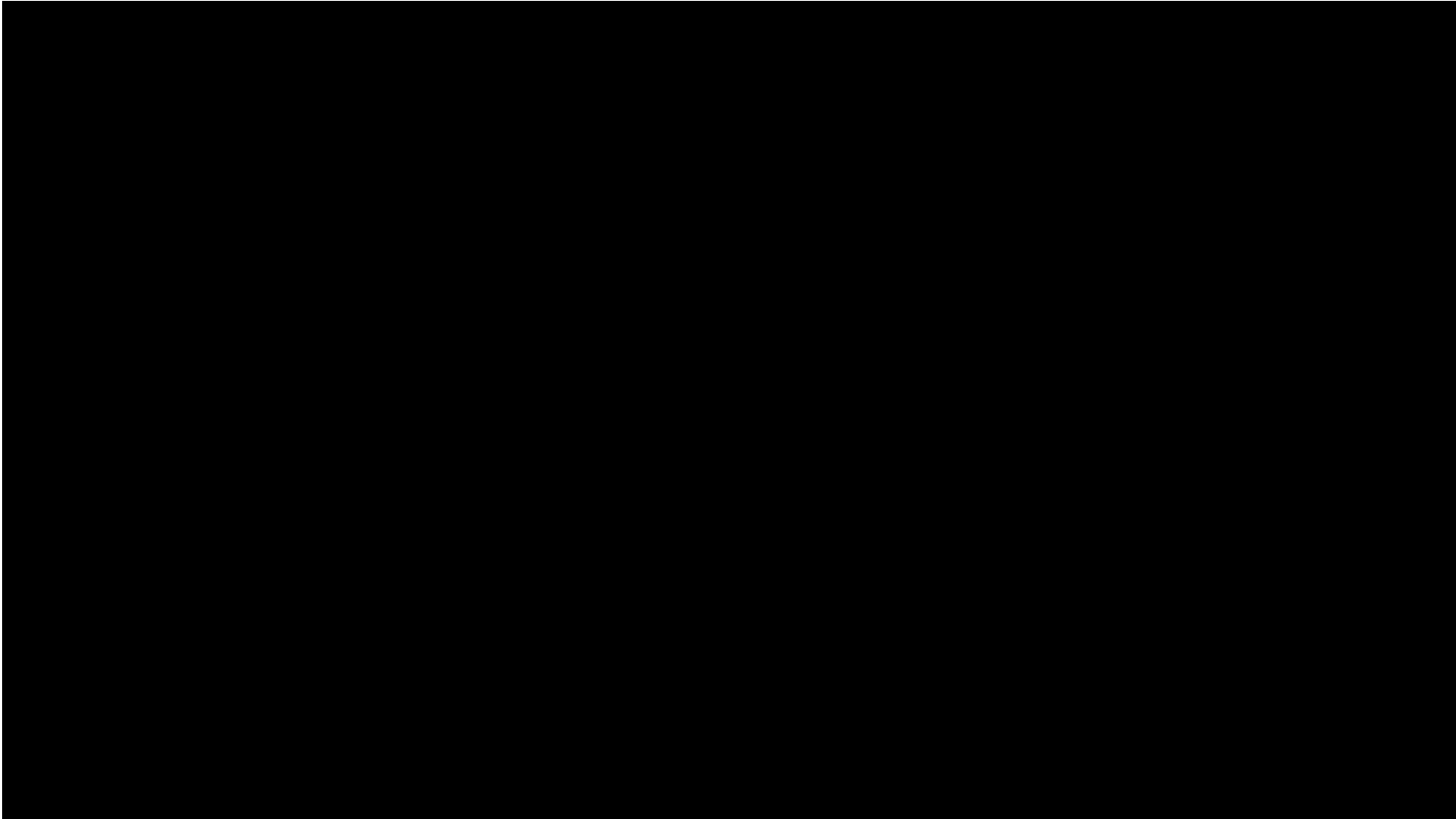
2nd Half of the Story

- 45% of global greenhouse gas emissions come from the way we make and use products and food.

That means we need to redesign our economy

- Eliminate waste and pollution
- Recirculate products and materials
- Regenerate nature

- We need a circular economy to help us reach NetZero



- Sustainability
- NetZero transition
- Linear vs. circular economy
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Human needs and some psychology

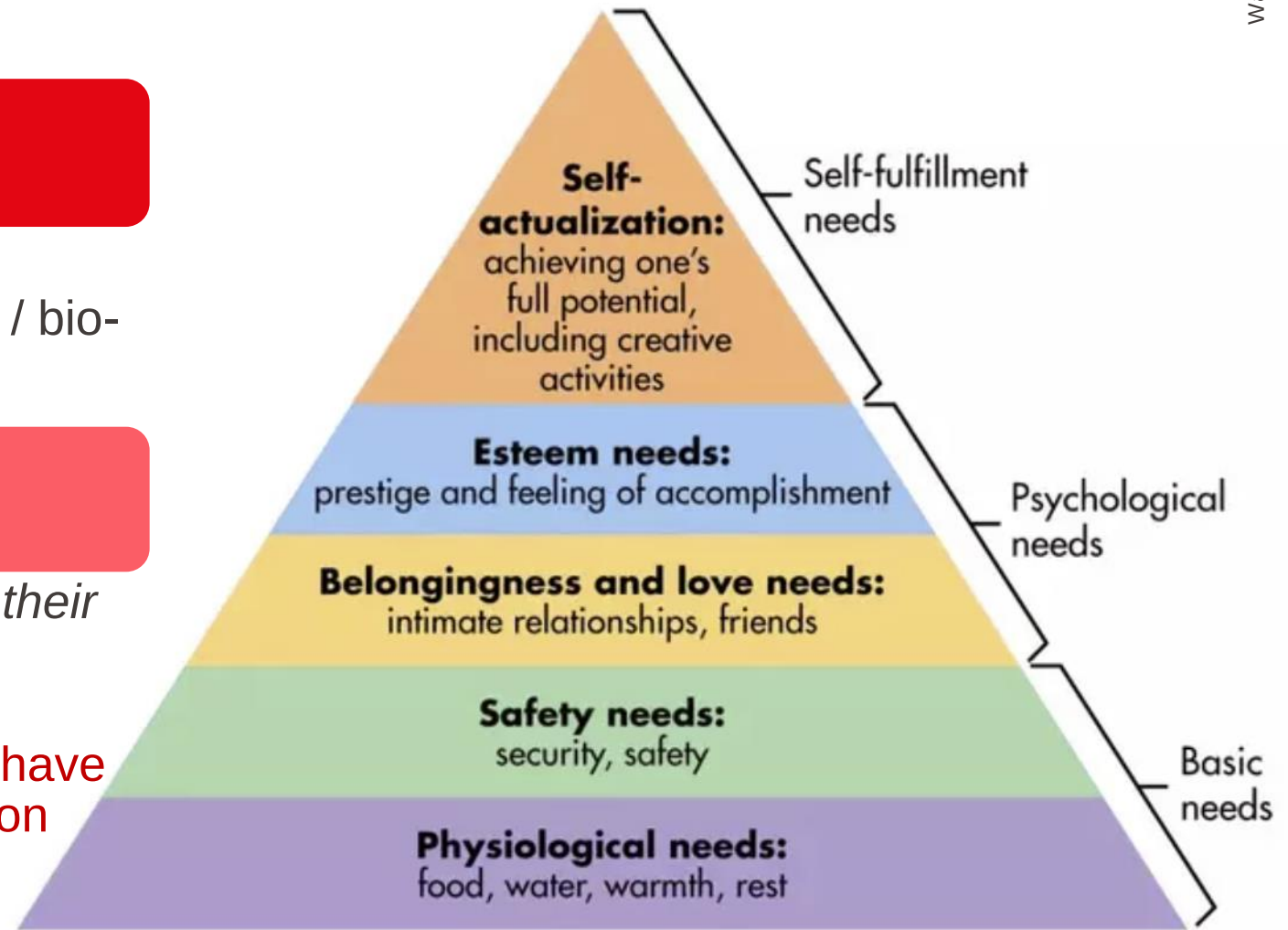
- We look to fulfil our needs

In the west

- We look to self-actualize
- Prepared to pay more for an ecological / bio-based / premium product ...

While ... many others

- *across the world are still trying to meet their basic human needs of food, water, and shelter*
- needs are so pressing that they do not have the head space to consider the impact on future generations as they are trying to survive and feed their children.



- People or nations might not cooperate even though it would be in their combined best interests to do so
- By prioritizing their personal or national interests, individuals acting rationally can create a worse overall result.
- We need to embrace change, take the strain, and address the issue together.

FINANCIAL TIMES

Climate change and the prisoner's dilemma

This problem demonstrates the tension between selfishness and co-operation

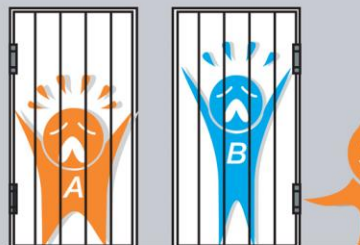
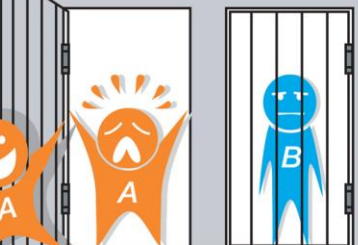
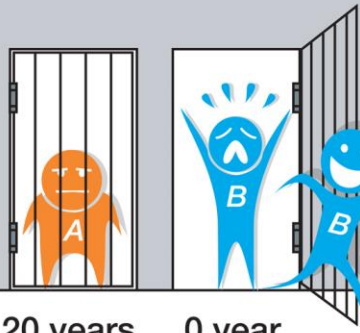
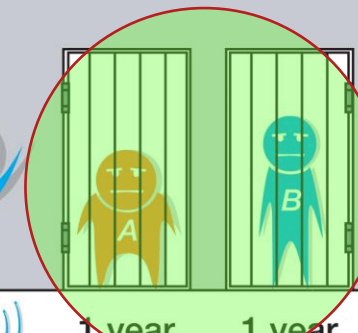
TIM HARBORD + Add to myFT



Every nation benefits if others restrain their pollution, but we all prefer not to have to restrain our own © SashaSteinbach/EPA/Shutterstock

The dilemma, then, is that **mutual cooperation yields a better outcome** than mutual defection but is not the rational outcome because the choice to cooperate, *from a self-interested perspective, is irrational.*

Prisoners' dilemma

		prisoner B	
		confess 	remain silent 
prisoner A	confess 	 5 years 5 years	 0 year 20 years
	remain silent 	 20 years 0 year	 1 year 1 year

© 2010 Encyclopædia Britannica, Inc.

1. Business

- There is money lying on the floor to be recovered from operational efficiencies.
- Need to introduce true pricing of externalities (waste / emissions)
- These need to become definers for success and promotion, really not just in theory.

October 01 2020

Climate in the Boardroom: Struggling to Reconcile Business as Usual & the End of the World as We Know It

Rebecca Henderson

> Author and Article Information

Daedalus (2020) 149 (4): 118–124.

https://doi.org/10.1162/daed_a_01821

[Climate in the Boardroom: Struggling to Reconcile Business as Usual & the End of the World as We Know It | Daedalus | MIT Press](#)

**Prof. Henderson
(Harvard business
school)**



- Need to reinvent capitalism as the old model did not efficiently apply scarce resources and we are overheating the system, AND its people.
- We need to shift the ethical framework of capitalism, and our own behavior and buying decisions

2. Core values and convictions

- We are emotional people who have values and personal ethics. This is part of us. We cannot deny it or we are not true to ourselves.
- Without it change cannot be catalyzed to make the phase change occur in the ethical framework of capitalism.
- We need to redefine the box by which we are assessed beyond the bottom line and bring our convictions into the work place.
- A commitment to prosperity and freedom is wider than we think.

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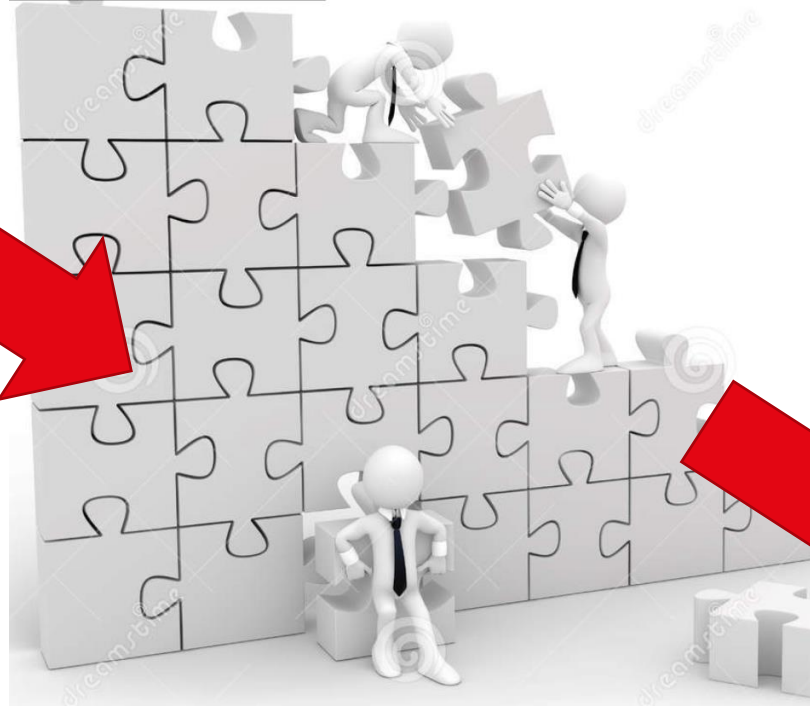
If we take risks in
decision making
then we can choose
to do this for what
we really believe in.

We can each bring a piece of the jigsaw puzzle

- Together we can make a difference



[Does information matter for completing the 1,000,000 piece climate change jigsaw puzzle? – RealKM](#)



[Director and Employees Working Together Stock Illustration - Illustration of building jigsaw: 17794530 \(dreamstime.com\)](#)



[People Forming Jigsaw Puzzles Stock Photo by ©Rawpixel 60054037 \(depositphotos.com\)](#)



- Think of 3 SMART sustainability initiatives

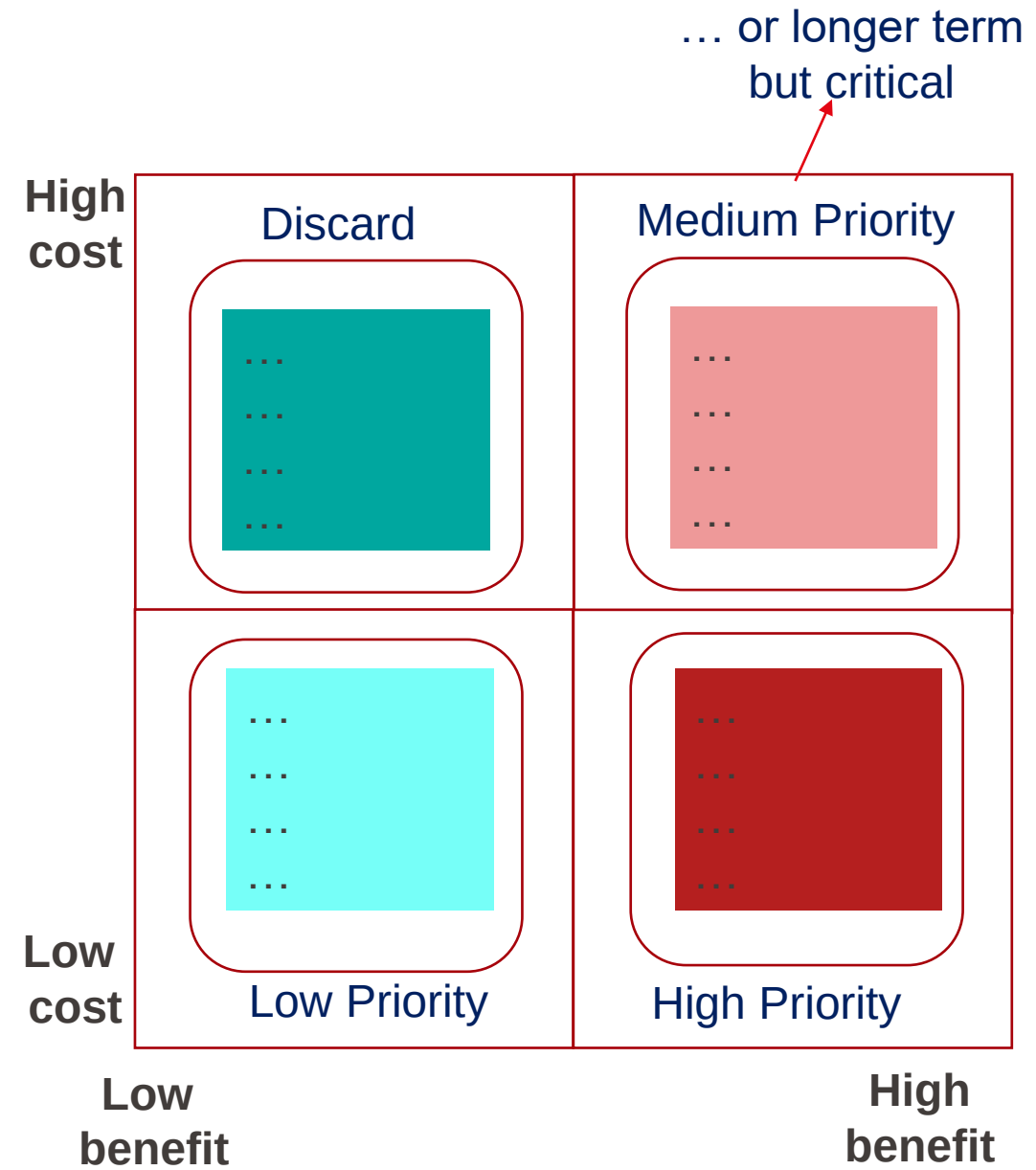


[SMART objectives - Bing images](#)

What are Strategic Initiatives? How to Develop & Execute
+ Examples (cascade.app)

Sustainability initiatives

- Operations focused
 - Product focused
 - Supply chain
 - Industry wide
-
- **Develop strategic mix of**
 - **Short**
(fast to implement, low cost/high benefit)
 - **Medium**
(transition to the future)
 - **Longer term**
(high risk, high benefit, maybe high cost)



Example: SMART initiatives



Initiative description	Next steps	Impact	Challenges	Resource needs	Key dates	Stakeholders
- Install PV panels on 1000m² of factory roof - Generate 540 kWh/day to reduce scope 2 emissions by	- Research benefits on product LCA - Choose 3 suppliers - Quotation by end of August - Presentation to board September 20th	- Reduce CO2e from oil heating (25.2 g CO2e vs. 1kg CO2e / kWh fossil fuels) - PV production impact recovered in 1 year - Abate 30 tonnes CO2e/yr	7-8 year payback period - Site assessment	25% of project engineer for 9 month 200k CHF CAPEX	- Quotation end August - Decision end Oct. - Planning permission to end December - Operational target April 2025	- Building services manager - Chief sustainability officer - Customers (demanding lower CO2e in our commodities) - CFO - LCA group